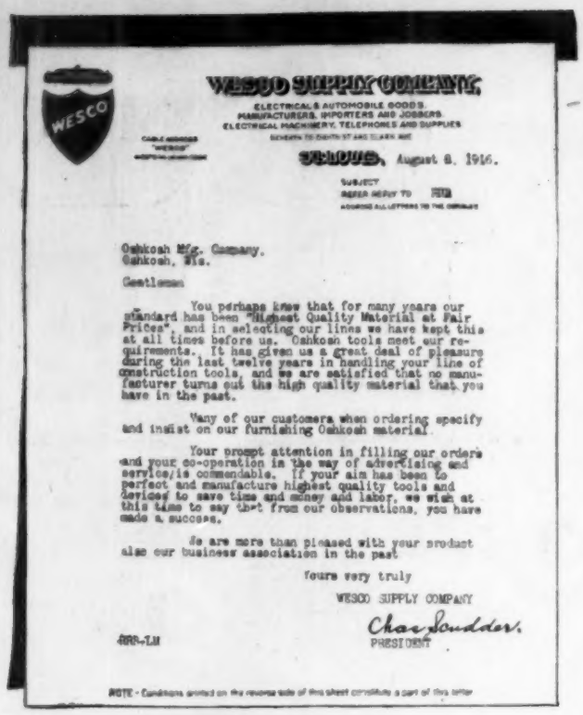
Volume XVI OCTOBER



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SAINT LOUIS, August 8, 1916.

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Oshkosh, Wis.

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Yours very truly

WESCO SUPPLY COMPANY

Chas Goudder.
PRESIDENT

HRR-LH

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VOL. XVI CHICAGO, OCTOBER, 1916 NO. 4

Lengthening the Convention

THE convention of the United States Independent Telephone Association this year will have a four-day program—one more than usual—the dates having been set for December 5, 6, 7 and 8.

All those who have taken active part in the previous Independent conventions have felt that three days' time was all too short for the thorough consideration of the many and complex problems that the progress of the year brings forth. An important subject abandoned at its climax because it is encroaching upon the time of another important subject misses its solution and loses its force. The calendar of convention proceedings should not be crowded, for what is worth discussing is worth exhausting.

The convention exhibits of manufacturers are always intensely interesting. They are made so at great expense and are, of course, frankly intended to attract all the attention and absorb all the time that the visitors can give to their examination. This, unfortunately, has almost placed the convention sessions and the exhibitions in the position of competitors for the attention of the delegates. The association officials have been forced by the demands of their program to request the exhibitors to lock their doors during sessions. The exhibitors, on the other hand, have been forced by the stern necessity of getting their money's worth to meet that request less than half way. The result has not been wholly satisfactory.

The plan this year is to devote the mornings to the exhibitions and the afternoons to the sessions. Under this eminently fair division of the delegates' time, there should be no interference between the two main features of the convention; and no visitor, whether he is listening to a convention speaker or arguing with an exhibitor, will experience the uncomfortable sense that he may be missing something by not being at the other place.

The new arrangement, simple as it is, promises to be more satisfactory all around than the old one. The sessions unquestionably will gain attendance, for even those whose main object in coming to Chicago is to look over the latest thing in equipment can lose no chance at trade by sitting in at the discussions. And from the other viewpoint, those faithful and duteous ones who have always sacrificed the pleasures of exhibit exploration to the call of the meetings—and who, we may assume, are very desirable customers—will have plenty of opportunity to get acquainted with sales managers and factory engineers.

Altogether, we like the new four-day plan.

When the Government Withholds Its Consent

WHEN the A. T. & T. Company made its oft-mentioned commitment to the United States Department of Justice, three years ago, the clause relating to possible absorptions of competitors specified that the advice of the attorney general should be obtained where merger negotiations were already under way. The spirit of the proposal was that no further absorptions should take place, even if previously agreed upon, without the approval of the government. Unfortunately for the smooth progress of the merger program, the commitment

failed to provide a course to be followed in case the Department of Justice declined to give an opinion.

Apparently silence does not always give consent; or at least the Bell company does not consider it safe to proceed on that theory. The long-negotiated merger of the Chicago automatic system and the Chicago Telephone Company was finally abandoned, a few days ago, simply because the United States attorney general refused to say whether he considered it legal or not. Having proposed to abide by his opinion, and then not being given any opinion to abide by, the parties to the deal could do nothing—which they promptly did. So now the Chicago Tunnel Company folks are seeking consolation in the only way left—an eight million dollar suit against the Bell company.

Whether the Buffalo case is in any way parallel to the Chicago case is not entirely clear. It will be remembered that the commitment (dated December 19, 1913) positively renounced any and all subsequent merger activities, and only asked consideration of those whose negotiations had been started prior to that date. B. G. Hubbell, president of the Federal company of Buffalo, announced his intention to sell out on January 22, this year—over two years after the Bell company had promised not to undertake any more Independent absorptions. But whether merger overtures had been made at Buffalo, in one direction or the other, prior to the date of the commitment, we do not know. If so, the right to claim consideration for the deal may be admitted on a technicality.

At Buffalo, in spite of the possibility of a referendum vote favoring the merger, in spite of the approval of commercial associations and city officials, the consent of the United States Department is still to be gained. And if—as seems to be its tendency—the department withholds both its consent and its refusal and continues to maintain a dignified silence, it is likely that the Buffalo merger will not take place. Government approval is a positive thing; its absence is most safely construed as disapproval.

Every telephone man knows that hundreds of mergers between Bell and Independent companies have been completed since December 19, 1913. Not many besides the interested parties know how many or how few of these mergers were contracted before that date, and developed at leisure. In most cases the inquiry on this point was desultory and without vigor.

But the Chicago and the Buffalo cases have had turned upon them the bright beam of publicity. Both have been as widely advertised and as thoroughly and publicly discussed and argued as though a large appropriation had been expended for that express purpose. Publicity is always a deterrent to doubtful action. It should have its share of credit for the Chicago fiasco, and will have its weight in the Buffalo project.

The attitude of the Department of Jutsice in any specific case is beyond the power of any man to predict. The only guess that has more than an even chance is that in the important cases the department will maintain a sphinx-like silence, thus passing the buck to the courage of the contracting parties to "bull" it through and face the consequences—if there be any.

The failure of the Chicago scheme is already having its salutary effect upon other merger situations. Local authorities in dual-service communities are commenting upon it with much speculation and conjecture. Before it is forgotten it will probably have deterred some other aspirants to absorption from pursuing their ambitions further. That, indeed, is its sum total of value, apparently, to the Independent cause; for at present the Chicago Independent does not look like an asset.

It has been questioned also whether the Buffalo Independent can be regarded as a credit to Independent telephony. One is almost tempted to feel that selling an operating company which has demonstrated its inability to succeed is good riddance—especially if the competitor loses money in the transaction, as apparently happens at times.

But the Buffalo company, like the Chicago and like almost all Independents, had certain obligations to its fellow Independents which cannot rightfully be abrogated. There are other companies which depend upon the Buffalo connection for their outlet. If the Buffalo merger is unpreventable, under no circumstances should it be permitted to mature until full provision has been made for the continuance of Buffalo and long distance connections for those companies which have connected with the Federal. That is the first and most important consideration of the situation.

The Relation of Western Electric to the Bell System

THE relation of the Western Electric Company to the Bell system is the object of considerable interest just now, particularly to the Independent field in both its operating and manufacturing branches. That is our reason for publishing, on another page, the article on that subject prepared by the Western Electric Company's president, H. B. Thayer, for the company's house organ. Having decided to give it space, our further reasons for reprinting it without deletion or alteration should be obvious. Since it may be regarded, in a way, as a Bell brief, strict justice demands that we present it, if at all, as it was written, and not edited to correspond to our own ideas of the situation.

Our Independent readers will contend that Mr. Thayer's article throws little light upon the propriety of the Western Electric's one-sided competition with Independent manufacturers.

We are inclined to agree with that view. There is no reason to suppose it intended to illuminate that subject, since even the title considers the relation of the Western Electric only to the Bell operators and not to the Independent operators. The article is virtually an exposition of the advantages of co-operative buying and selling. That such arrangements have advantages is the popular impression. That the Bell operating companies are entitled to those advantages would seem a reasonable conclusion, from a layman's standpoint. Whether it is reasonable in a legal sense has yet to be passed upon.

There is no reciprocal balance in the condition which allows the Western Electric Company to compete with Independent manufacturers in their field, and does not allow Independent manufacturers to compete with the Western Electric Company in its field. That is manifestly unfair in an ethical sense. Whether it is unfair in a legal sense has yet to be decided.

Some who have argued for the dissolution of the Bell-Western Electric ties have claimed to observe a growing restlessness in the ranks of the Bell operators themselves, an ill-suppressed ambition to buy on the open market. Our only comment on that theory is that the restless spirit need but grow to a fifty-one per cent strength, and the dissolution will automatically take place. For the Bell organization controls the Western Electric; the Western Electric does not control the Bell. That the Bell operating companies continue the arrangement is sufficient proof that they like it.

Those Independents who want something done to the Western Electric (which certainly should include all the Independent manufacturers if not all the operators) are divided in choice between two penalties:

Either they want it denied the right to sell to Independent operators while it is Bell controlled, or they want it denied the right of Bell control while it sells to Independent operators.

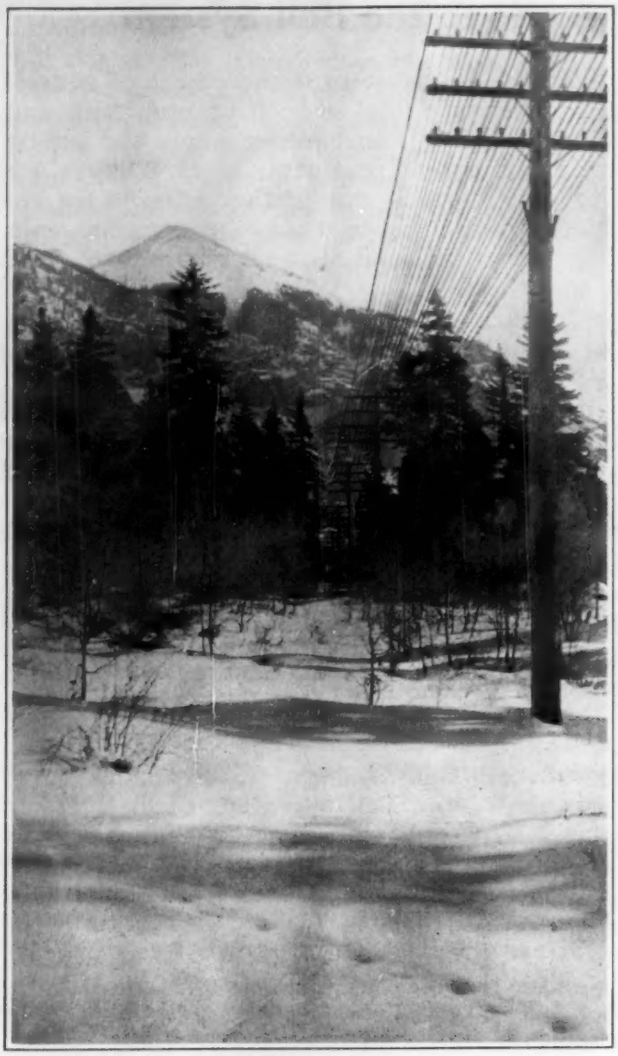
Which of these hypothetical arrangements might be the better for all concerned seems open to discussion. Our own attitude on the subject we have expressed repeatedly in these pages.

Further argument will not throw the ultimate result either one way or the other. The vital question is not which condition would be most convenient for one faction or the other, but which—if either—is the one and only legal solution.

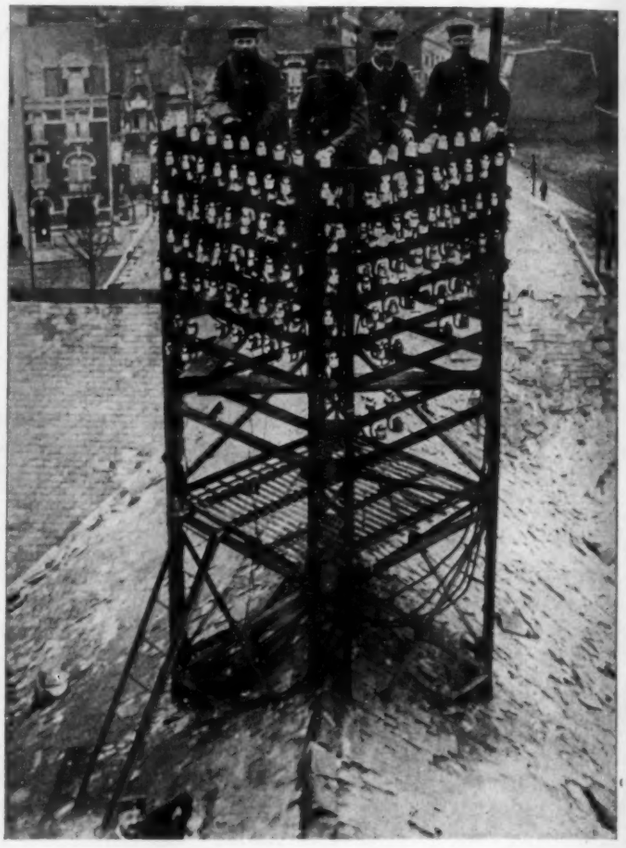
The protested points about this Bell-Western Electric combination never have been legally adjudicated. Until they have been passed upon by the proper authorities it is idle to express mere hypothetical views upon the ethics and the morals of the situation however righteous those views may appear to the lay mind.

We presume the Independent interests are doing all that can be done to relieve the condition and that their protests are being pressed before the tribunals that have jurisdiction with all vigor.

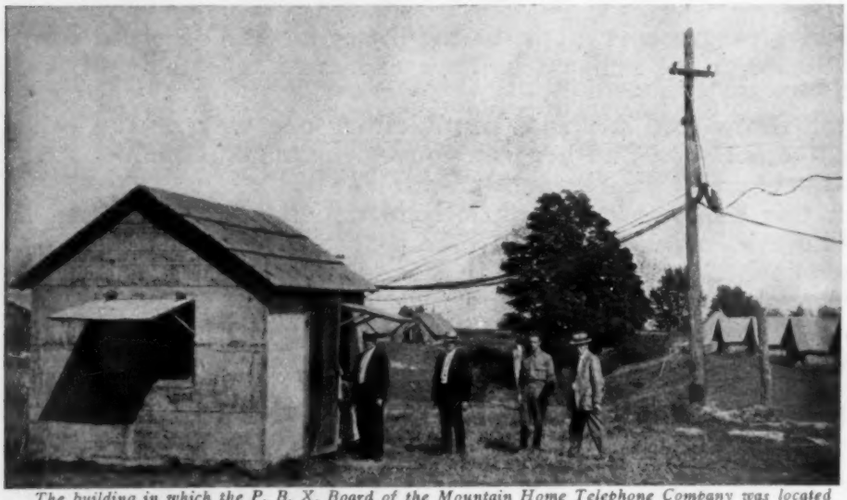
Some day, no doubt, we will get a dispatch announcing that the Western Electric is independent of the Bell, or that the Western Electric is wholly Bell and cannot deal with Independents, or that the Western Electric-Bell relation will be allowed to remain as it is. Which of these three directions the ultimate decision on the relation will take we cannot even guess.



A scene in the wild mountain country near Ouray, Colorado, where the construction crews of the Mountain States Telephone Company had to blaze a telephone trail through the dense forest.—The Mountain States Monitor.



A German army telephone lineman repairing wires on roof fixture on top of a church in the war zone. Montgomery Schuyler, New York Times correspondent says: "The greatest single point of efficiency is undoubtedly the splendid system of telephones. This effective system is found everywhere on the entire front, connecting every point with every other point. Each trench has its own means of communication with others, and each officer has an instrument at his pillow.—Telephone Review.



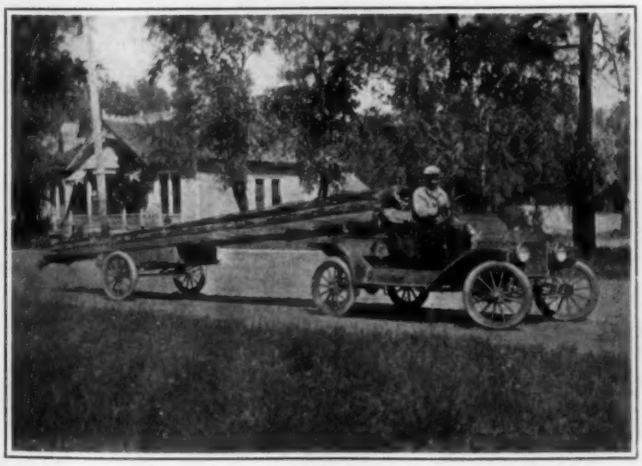
The building in which the P. B. X. Board of the Mountain Home Telephone Company was located at the Plattsburg, N. Y., Military Training Camp.—The Telephone Review.

Using a railroad rail at a bad turn in telephone construction in the Panama Canal Zone.—The Telephone Review.

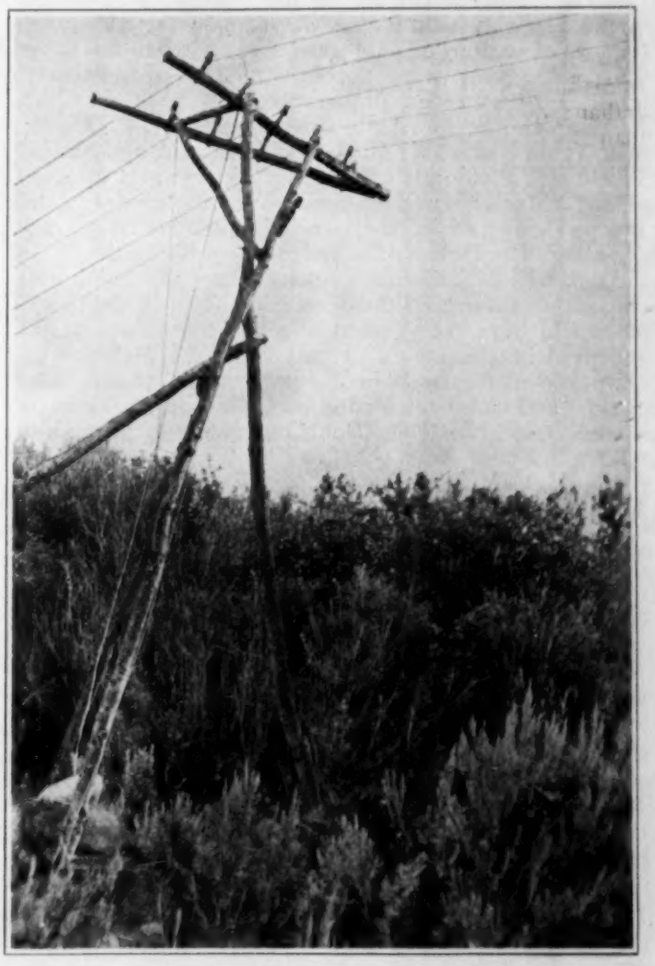
STORIES IN PICTURES OF TELEPHONE PRACTICE AND PROGRESS IN ALL PARTS OF THE WORLD.

One of the Big White Trucks which haul poles and tools and other construction necessities in and around Denver for the Mountain States Telephone Company.—The Mountain States Monitor.

The Jungle Along the Canal Zone where telephone construction work is being done by the Third Platoon, Telegraph Company H, United States Signal Corps. After the completion of the Panama Canal, troops of the regular army were sent to Panama and established military posts at Camp E. S. Otis, Empire, Culebra, Corozal, Gatun, and Quarry Heights. Last fall a platoon of Telegraph Company .H,. Signal Corps, was sent to the Isthmus to build the necessary telephone system for these posts. The work, which was done under the direction of Major C. McK. Saltzman, Signal Corps, has been completed, and each post now has a modern central energy .system with an instrument in every office, barrack and officer's quarters.



That the Flivver is not limited in its capacity for doing good by the cubical contents of its interior is demonstrated by this picture of Mr. Hall, of the Mountain States Telephone Company, at Leadville, Colorado, hauling thirty foot poles.—The Mountain States Monitor.



A Grown-to-Order Telephone Pole.—The photograph reproduced here is of a species of quaking asp that grows in Montana, and is found largely in the vicinity of small local telephone companies. The young shoots from these trees are passed from one company to another and in this way they get away from the heavy expense for pole line, when they wish to build. All that is necessary is to put the small shoot in the ground and in a year or two—presto—the pole is there, fully equipped with cross arms and pins, which develop with the second year's growth. All that the telephone company furnishes is the glass insulators.—The Mountain States Monitor.

STORIES IN PICTURES OF TELEPHONE PRACTICE AND PROGRESS IN ALL PARTS OF THE WORLD.

Indianans Hold Big Convention

More than 300 members of the Indiana Independent Telephone Association and their friends were present at the opening of the tenth annual convention of the association at the Claypool Hotel, Indianapolis, Thursday morning, September 14. The meeting was called to order by Hart F. Farwell of Terre Haute, president of the association, and an address of welcome was given by Mayor Bell. In welcoming the members of the association to Indianapolis, Mayor Bell thanked the Independent telephone companies for the work they have done toward the development of a greater Indiana.

"One of the first things that you have done," said the mayor, "was to lower the cost of the telephone and elevate its efficiency to a high standard."

William Fortune, president of the Indianapolis Telephone Company, responded. In thanking the mayor for his address he said no telephone company in the country has received better co-operation from the city officials than the Independent Telephone Company of Indianapolis.

The business meeting of the convention was held in the assembly hall of the Claypool in the afternoon. Reports of various officers were read and committees for the coming year were appointed. The committee on traffic and engineering problems consists of E. L. Cline, Indianapolis; F. X. Staub, Fort Wayne; A. L. Staderman, Terre Haute; W. M. Bailey, Richmond, and Samuel Tomlinson, Plymouth. After the business was disposed of F. B. MacKinnon, vice-president of the United States Independent Telephone Association, delivered an address on "The Outlook for Independent Telephony." In his talk Mr. MacKinnon explained how the training of efficient operators and the developing of an efficient service would have the greatest effect in the future of the Independent companies. Frank Beam of Mt. Vernon, O., president of the Ohio Independent Telephone Association, and Gansey Johnston of Columbus, O., manager of the Ohio State Telephone Company, also gave short talks.

A new feature that was held in connection with the convention this year was the Operators' School of Instruction, in the palm room of the hotel. The long distance and some local operators were instructed in many of the new methods of the Independent companies. Operators from all parts of the state were in attendance, and the novel plan proved very beneficial. The school was in charge of W. S. Vivian of Chicago, secretary of the United States Independent Telephone Association, and F. V. Newman of Grand Rapids, Mich., secretary of the Michigan Independent Traffic Association.

The day's sessions closed with a banquet in the Riley room of the Claypool. Several novel features in the way of entertainment were carried out. These, for the main part were under the direction of Harry Porter of Indianapolis.

The convention closed Friday evening with the election of officers. Hart F. Farwell was re-elected president and Frank E. Bohn secretary-treasurer. The executive committee—the officers and Walter J. Uhl, J. A. Browne, William Fortune, F. R. Parrett, W. M. Bailey, S. M. Isom, W. W. Harbaugh, E. E. Daicey, N. R. Lebo, C. R. Stoops, J. H. Kneale. Several addresses were given by prominent men of the United States Independent Telephone Association. The school of instruction also was continued the last day of the convention.

Farmers to Discuss Government Ownership

The Farmers' National Congress of the United States has been engaged for a year in a study of government ownership of telephones and telegraphs, through the researches of a committee appointed for that purpose at the Omaha session of this body last September. This report, which will be submitted at the thirty-sixth annual session of the Farmers' Congress at Indianapolis, Indiana, October 17 to 20, is said to be the most comprehensive study of this subject ever made from the standpoint of the farmer.

The committee having this subject in charge is said to have covered the whole field of government ownership of telephones and telegraphs as related to the agricultural interest, after extensive researches into the records of all government ownership countries. While the committee prudently declines to make public its findings in advance of its report to the congress, it is reported that this report will establish a new and accurate basis of facts from which to study the problem of government ownership.

A general invitation has been extended by the officials of the Farmers' National Congress to all interested persons to attend the Indianapolis meeting, at which 2,000 farmers are expected from the entire United States. Independent telephone men will do well to note this event and plan to attend.

Ohio State Earnings Grow

Ohio State Telephone Company reports revenue for July as $302,428.74, against $274,970.82 for July last year. Expenses, including taxes and insurance, were $176,040.78, against $154,488.12, leaving the net income $126,387.96, against $120,482.70. Deducting fixed charges of $50,508.31, against $46,514.59, leaves net earnings of $75,879.65, against $73,968.11. Dividends on the preferred stock were $26,671.31, against $26,087.98, leaving the balance available for financial requirements of company and dividends on common stock as $49,208.34, compared to $47,880.13 for July of last year.

New England Company Financed

The offering to shareholders of $7,891,050 of additional stock of the New England Telephone & Telegraph Company was an entire success. All the stock was taken and it is probable that at least 75 per cent of the stock will be full paid on the first installment. Had the stockholders desired, they might have paid for 50 per cent March 31, 1917. The company will make a very small gain in stockholders as the result of this financing. In other words, the present 5,000 stockholders have taken more than 90 per cent of the issue.

Independent Convention Dates

At the time we go to press the following dates have been decided upon for Independent conventions:

National, December 5-8.
Illinois, November 15-17.
Kansas, December 19-21.
Minnesota, January 23-24.
Wisconsin, February 6-8.
Oklahoma, February 19-20.
Texas, February 22-23.
Iowa, March 14-16.
Ohio, November ——. (Date not decided.)

Theory of Probability Applied to Traffic

A Short Method of Solving Problems Relating Particularly to Telephone Trunking

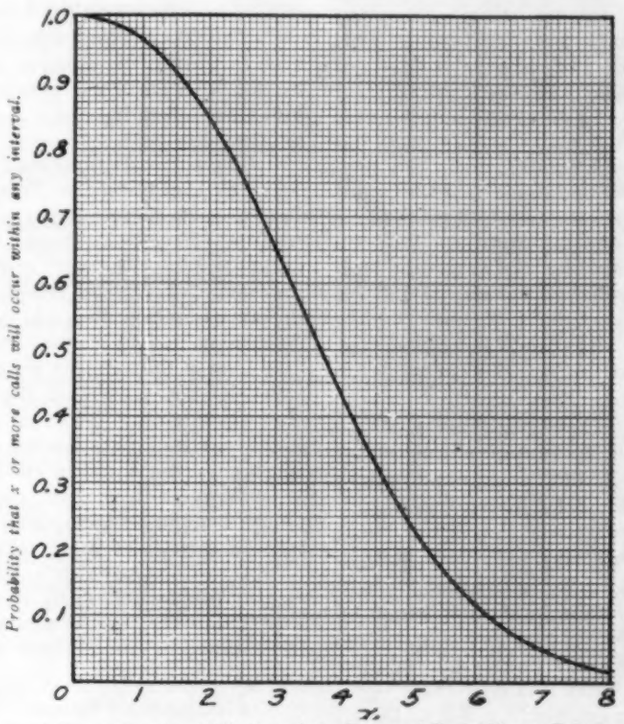
BY J. S. BAKER

THE theory of probability is somewhat involved, but even when thoroughly understood a prodigious amount of labor is frequently necessary for the solution of problems dealing with probability.

The purpose of this article is to disclose a short method of solving problems which relate particularly to telephone traffic.

From algebra we have the following laws:—If an event can happen in a ways and fail in b ways, and all of these $a+b$ ways are equally likely to occur, and only one can occur, and one must occur, then the probability of the happening of the event is equal to $\frac{a}{a+b}$ and the probability of the failure of the event is equal to $\frac{b}{a+b}$.

If p represents the probability of the happening of an event in one trial and q represents the probability of its failure, the probability of the happening of the event x or more times in n trials is equal to the sum of $n-x+1$ terms of the expansion of $(p+q)^n$.



Graph Illustrating the Application of the Theory of Probability to Telephone Trunking.

To apply these principles to telephone traffic let us assume 100 B. H. calls per hour, two minutes holding time, and seven out-going trunks, and let it be required to find the probability that the trunking facilities will be loaded to capacity or over.

Two minutes is equal to $\frac{1}{30}$ of one hour, so we can assume the hour to be divided into 30 intervals. We shall now choose any one interval and assume one call to be sent through. Obviously, this call can fall within the chosen interval in only one way, while it can fail to fall within the chosen interval in 29 ways, viz., by falling within any of the other 29 intervals. Then, according to the principles previously laid down, the probability of the happening of the event is equal to $\frac{1}{1+29}$ and the probability of its failure is equal to $\frac{29}{1+29}$.

Therefore, $p=\frac{1}{30}$, and $q=\frac{29}{30}$. p is the probability of the happening of the event in one trial, or when only one call is sent through. Now, we can assume that these 100 different calls are repetitions of the first call. In other words, we make 100 trials, and knowing the probability of the happening of the event in one trial, we wish to find the probability of its happening 7 or more times in 100 trials. As previously stated this is equal to the sum of $n-x+1$ terms of $(p+q)^n$, which is equal to the sum of 94 terms of the expansion of $\left(\frac{1}{30}+\frac{29}{30}\right)^{100}$

The expansion of a binomial of this form is usually prohibitively laborious, but by using the formula which we shall now derive, it is possible to secure the sum of any desired number of terms in a very short time.

If the sums of the terms of the expansion be plotted as ordinates, and x as corresponding abscissa, the curve will have the general form shown on the accompanying graph. The general equation of a curve of this form is $Y=Cx^a$, in which C and a are constants to be determined and Y is the probability.

Evidently, when $x=1$, $Y=C$, which is the probability that one or more calls will fall within the chosen interval. Also, Y equals the sum of $n-x+1$ terms of the expansion of $(p+q)^n$ which is the sum of 100 terms of

$$\left(\frac{1}{30}+\frac{29}{30}\right)^{100}$$

Since the sum of the entire 101 terms is equal to *one*, we have only to subtract the last term of the expansion from *one* to obtain the value of C. Therefore, $C=1-q^n$.

To find the value of a let us assume that x equals 2. Then Y equals 1 minus the sum of the last two terms of the expansion. Or, $Y=1-(npq^{n-1}+q^n)$. We can now transform our equation and solve for a in terms of n, p, and q as follows:

From $Y=Cx^a$ we obtain, by substituting the values just found, $1-npq^{n-1}-q^n=(1-q^n)2^a$.

$2^a=\frac{\log\ (1-npq^{n-1}-q^n)}{\log\ (1-q^n)}$, from which $a=\frac{\log\frac{\log(1-npq^{n-1}-q^n)}{\log\ (1-q^n)}}{\log\ 2}$

Then our complete equation is

$$Y=(1-q^n)^{x\ \log\frac{\log(1-npq^{n-1}-q^n)}{\log\ (1-q^n)}}$$

And applying this to the solution of the proposed

problem we get

probability $= .9663^{2.30712} = .047$ or practically $\frac{1}{20}$

By referring to the accompanying graph it can be seen that this corresponds to the results secured by taking the sum of the terms of the expansion.

Lincoln Company Had Good Year

Earnings of the Lincoln (Neb.) Telephone & Telegraph Company during the fiscal year of 1915-16, ending June 30, reached the sum of $1,285,769, not including miscellaneous revenues from other than operating sources. The operating expenses were $826,889. This left $458,880 of net revenue. The company declared dividends amounting to $337,622 and paid interest on bonds to the amount of $49,136. The yearly surplus was $20,400.

Operating revenue increased $86,000 over the previous year; operating expenses increased $63,000, and the net revenue was $23,000 greater, while $5,000 more went to surplus than in the preceding annum.

Exchange revenue increased by $67,000, and toll revenue by $21,000, while miscellaneous revenue fell off $2,000.

The company charged as depreciation reserve for the year $221,866 out of its earnings. It expended for ordinary repairs $83,251.

Stock of the company now outstanding totals $5,684,837, and the bonded indebtedness is $1,202,000.

Citizen's Telephone Report Shows Gain

The annual report of the Citizens Telephone Company of Grand Rapids, Mich., for the year ending June 30 has been sent to stockholders. The financial statement shows operating earnings $894,168, an increase of $56,862 over the preceding year, and gross earnings $925,628, an increase of $55,984. The operating and general expense and $56,896 taxes paid totaled $452,310, an increase of $25,250. The net earnings are $473,318, an increase of 30,733, or about 7 per cent. A balance of $278,339 for dividends and surplus, an increase of $24,350, is left after deducting for amortization and depreciation. The dividends call for $231,104, $5,951 is appropriated to the sinking fund and $41,288 is carried to surplus, as compared with $18,388 last year. The earnings above interest and amortization charges are $437,670, or 10.9 per cent on the outstanding stock. The balance sheet shows an increase of $124,087, the largest items being $77,436 in exchange and toll line investment, $11,997 construction work in progress and $16,926 in the stocks and bonds of subsidiary companies. The liabilities show $22,000 increase in bonded indebtedness, $56,594 in depreciation reserve and $39,594 increase in surplus.

The Citizens Telephone Company has 3,069 stockholders, of whom 1,467 live in Grand Rapids, 1,097 in Michigan outside of Grand Rapids and 489 scattered in thirty-eight states and seventeen in foreign countries. The company has 15,180 telephones in Grand Rapids, an increase of 1,171 for the year, and the Grand Rapids investment was increased during the year by $45,349.

Cumberland Company Out of Indiana

The nominal passing of the Cumberland Telephone & Telegraph Company from the stage of public service in Indiana and in its stead the complete assumption of holding and operation by the Southern Telephone Company of Indiana was marked by the filing for record of a deed. In accordance with the document the Cumberland, a corporation organized under the laws of Kentucky, conveys absolutely and forever to the Southern all lands and real property held by it in Indiana for the consideration of $44,855.22 of the Southern's capital stock. The lands are specified as existing in Floyd and Vanderburg counties, with all buildings and improvements. The deed was made in Fulton county, Georgia.

Telephone Lines Win in Iowa

The 5,000 rural telephone lines of Iowa have won a victory over the electric lines of the state in a decision by the state railroad commission that telephone companies now operating have priority rights over future electric lines.

The commission makes this ruling in granting a franchise to the Peterson Power and Milling Company of Peterson, to construct a transmission line in Buena Vista county. It provides that the Peterson company may build its line, but that it must pay whatever expense is necessary to rebuild telephone lines along the route of the transmission line, so as to withstand the electrical disturbance.

Under the present type of rural telephone construction electric lines put the telephones out of commission completely. Most of the telephone lines now are grounded systems, having a single wire. To permit service in the vicinity of electric lines, telephone lines must be metallic circuit, requiring two wires. The telephone companies complained it would take $5,000,000 to rebuild their lines into metallic circuit lines.

The railroad commission has decided that the telephone companies need not stand this expense. The board says that if the electric lines want franchises they must take care of the telephone lines already operating.

Druggists Protest "Telephone Spongers"

That part of the public making a practice of "sponging" on drug stores in the use of telephones was the subject of discussion at the sessions of the eighteenth annual convention of the National Association of Retail Druggists at the Claypool Hotel, Indianapolis, September 19.

Following the report of Wilhelm Bodemann of Chicago, chairman of the telephone committee, this bane of the retail druggist came in for a good share of unfavorable comment. It was decided that the only remedy was to make all drug store telephones pay stations and divide the proceeds, on an agreed percentage, with the druggists.

Ohio Convention in November

Following a successful meeting at Indianapolis last month of the Indiana Independent Telephone Association, plans are being perfected for a large gathering in Columbus of Ohio Independent companies in November. Rollo Stevens of the Ohio State Company, who attended the Indianapolis meeting, says extraordinary increase in the use of Independent telephones was shown by reports.

One feature that may be adopted at the Ohio meeting was separate gatherings of chief operators, supervisors and toll operators. After these had gone over their own problems, they met in joint session and all attended the banquet given in the evening.

Buffalo Merger Situation Complicated

Considerable Activity Centers About Sale of Hubbell's Company

MAYOR FUHRMANN and the councilmen of Buffalo, N. Y., in committee September 26 unanimously agreed to approve the proposed merger of the New York and Federal Telephone companies, but on terms not satisfactory to the companies. Objection is made by Daniel J. Kenefick on behalf of the companies to several clauses in the resolution adopted by the councilmen.

Conditions are attached to the merger proposition safeguarding the public as follows:

First—Providing that existing rates shall not be increased, except upon order of the public service commission, after hearing, the burden of proof being placed on the New York Telephone Company, and the city reserving the right to oppose such proceeding.

Second—That the action, pending on appeal, in which the city of Buffalo is plaintiff, be discontinued without costs to either party and that the Federal Company pay to the city the amount claimed in said action, together with a further sum of $13,895.50 with interest as a percentage of its gross earnings for the year 1913; a further sum of $14,166.41 with interest, percentage of gross earnings in 1914, and a further sum equal to three per cent of its gross receipts for 1914-15, with interest.

Third—Space in underground conduits to be reserved for the use of the city, free of expense, for telephone and telegraph wires of city departments.

Fourth—The city to have the use, free of expense, for the purposes of space in all conduits now maintained or hereafter constructed.

Fifth—The city to be allowod, free of expense, space on the company's poles for city department telephone and telegraph wires.

Sixth—The company to file with the city, within six months of the merger, an inventory and appraisal of all its property in the city "used or useful in the conduct of its telephone service" in the city, such inventory and appraisal to be itemized, and show separately those portions of the property in highways, and what portions are on private property.

Seventh—The Fedeeral Company to pay the cost of the examination of its books and records, made by H. C. Hopson at the request of the council.

Eighth—Consent of the council to the merger not to be effective until both companies file resolutions, duly authorized by their respective boards of directors, accepting the consent subject to the aforesaid terms and conditions, together with such agreements executed by their respective sureties to the satisfaction of the corporation counsel.

Mr. Kenefick after reading a copy of the resolution given out by Councilman Hill, chairman of the committee, said that it would not be accepted and it would be useless for the council to pass it. This is Mr. Kenefick's statement:

The companies will not accept conditions Nos. 1 and 2 because they are unjust and unfair. Condition No. 1 requires the New York Telephone Company to initiate a proceeding before the public service commission to modify its existing rates. Under the public service commissions law a telephone company has the right to modify its rates from time to time, subject always to a complaint against the reasonableness of the rates as filed by the telephone company. Condition No. 1 seeks to change the law of the state as to the local situation and require the New York Telephone Company to initiate a proceeding in order to modify its rates. We have no objection to the provision in the resolution that the New York Telephone Company shall file an inventory and appraisal of its property so that the city will be in full possession of all the information which it needs to initiate a proceeding against the reasonableness of any rates that may be proposed by the New York Company after the merger. This is a fair and just condition and one which can be accepted, but it is unfair and unjust to ask the New York Company to initiate a proceeding to obtain a right which it now possesses under the law.

In approving the merger the city is not binding itself in any way as to the reasonableness of any rates which may be filed hereafter by the New York Company, and the city will be in the same position after the merger that it is in now in regard to filing a complaint, except that with the requirement that the New York Company file an invenory and appraisal of its property, the city is in much better position to initiate the proceeding after the merger.

Condition No. 2 requires the Federal Company to pay to the city approximately $100,000 which the supreme court of this state has held to be an unjust claim, and the city has been defeated in its efforts to collect the claim by a judgment of the court. In other words, the Federal Company is being asked to pay an unjust and illegal claim, so determined by the courts, as the price of the city's consent to the merger. This is neither fair nor right. The city was defeated in this action 1½ years ago, and while it took an appeal it has never perfected the appeal, thus indicating that it has little faith in the strength of its position.

The Federal Company is entirely willing to give a surety company bond that in case the city finally succeeds in that action it will pay all of the moneys referred to in condition No. 2 of this proposed resolution, but it is neither equitable nor fair that the Federal Company should be compelled to pay it if the appellate court sustains the supreme court in its judgment that it is not a just or lawful debt.

The companies will not accept the resolution with the two conditions above named, and it would be quite useless for the council to pass any such resolution.

Asking that a referendum vote on the question of the proposed merger of the New York and Federal Telephone Companies, the question of a municipally owned telephone system, and of a municipally owned and operated electric plant and conduit system be taken at the coming elections, a petition signed by 8,656 citizens was filed with the city clerk of Buffalo September 7.

The three questions the petitioners would have submitted to the people are as follows:

Shall the city of Buffalo approve the proposed merger of the New York Telephone Company and the Federal Telephone Company, involving an increase in rates?

Shall the city of Buffalo ask the legislature to pass an act enabling the city of Buffalo to own and operate a municipal telephone system?

Shall the city of Buffalo own and operate an electric plant and conduit system to generate, purchase, sell and distribute electricity to consumers and lease conduits, in order to produce revenue and lower the tax rate?

The petition was circulated by the Central Council of Business Men's associations.

Referendum on the telephone merger proposition must be held, now that a petition seeking to place the question on the ballot at general election has been filed, according to an opinion submitted by Corporation Counsel William S. Rann to the Council.

Corporation Counsel Rann holds that the telephone merger question and the question concerning the municipal electric power plant must be placed on the ballot, but that the question as to whether the city of Buffalo should ask the legislature to pass an enabling act to permit Buffalo to own and operate a municipal telephone system must be omitted because it is not legal.

The report of H. C. Hopson, expert appointed to investigate the financial condition of the Federal Telephone & Telegraph Company, submitted to the council and referred to committee, makes it apparent that the company "must face serious embarrassment" if it attempts to continue to do business on its present lines.

"It appears from the statements for 1914-15," says Mr. Hopson, "that the company is falling short of earn-

ing expenses and fixed charges, including allowance for depreciation, by upward of $400,000 per annum."

After careful and thorough examination of accounts and affairs of the company, Mr. Hopson finds that statements made at the outset by representatives of the company did not understate the revenues, nor overstate expenses, either for operations of the company as a whole, or for those confined within the city of Buffalo.

Mr. Hopson, referring to the fact that the company's figures did not include depreciation, said exclusion of that item tended to make the profits of the company appear larger than they really were. Depreciation, says the expert, is an element of operating expenses which is required to be considered in the account of telephone corporations by the interstate commerce commission, and all public utility commissions. Such requirements, he says, are founded on sound accounting. By reason of the omission of this important factor, the company's showing for the first six months of the current year was even less favorable than it was made to appear.

Another weakness is pointed out in the statement as previously submitted, in that it was confined to results and operations in the city of Buffalo alone, and did not take in surrounding territory. For information, Mr. Hopson submits facts bearing on the company's operations between Buffalo and outside territory and long distance. The showing that the long distance is the only branch now resulting in profit is, in the mind of the expert, conclusive evidence that division of the subject is impracticable. While the company's operations in Buffalo show increasing loss, Mr. Hopson finds that the long-distance business was also becoming less profitable, although the loss in that territory in 1915 was less than it was in 1914.

Tables accompany the report giving a mass of information to substantiate the expert's findings. From a review of the company's outstanding liabilities, its inability to market additional capital obligations, and yearly approaching maturities on a number of its larger bond issues, Mr. Hopson reaches the conclusion that the company couldn't continue without "revolutionary changes" under existing conditions.

Frank C. Perkins, a consulting engineer of Buffalo, has written to the attorney general of the United States preferring charges against the New York Telephone Company and the American Telephone & Telegraph Company. He alleges that in seeking to merge with the Federal Company, the New York and American companies have broken agreements.

Independent Line From Reno to Tonopah

Prominent citizens of Nevada and Utah are identified with the Nevada Telephone and Signal Company which was incorporated the early part of last month under the laws of Nevada.

The company has been organized for the purpose of constructing a telephone line between Reno and Tonopah, something which has been needed for years. The line will follow the railroad via Hazen to Reno, a distance of about 250 miles, connecting with all the intervening mining and railroad towns and stations. The new company is affiliated with the Utah, Nevada & Idaho Telephone Company, which has its headquarters at Winnemucca, as the directing heads are almost identical.

The president of the Nevada Telephone and Signal Company is F. M. Manson of Reno, manager of the Western Ore Purchasing Company; Adrian Ellis of the law firm of Dixan & Ellis of Salt Lake, Utah, is vice-president; J. T. Goodin, cashier of the First National Bank at Lovelock, treasurer, and Hugh L. Thomas is superintendent. Thomas is also superintendent of the U. N. I. T. Company.

It is understood that the plans of the new company include the making of wireless telephonic experiments in various parts of the state. The company is capitalized at $250,000, the par value of the shares being $100 each.

Work on the new line has started at Winnemucca and will be rapidly pushed to completion. Work on the Reno end of the line will commence soon to connect up with Humboldt county points and in the meantime work will be pushed toward Tonopah as fast as possible.

Central Union Reports Deficit Last Year

A deficit of $198,927.69 for the year ending June 30 is shown in a report of the Central UnionTelephone Company of Indiana, which has been filed with the Indiana Public Service Commission. This deficit is noted after the company paid interest on its bonded indebtedness of $35,620,000 and paid a number of other expenses. The telephone revenues from Indiana amounted to $2,356,927.03, while the operating expenses were $1,750,850.49. The net telephone revenue was $606,076.54, while the operating revenue was $376,302.56. The gross income was $477,308.75 and the nonoperating revenue $101,006.19.

The total investment in Indiana, Illinois and Michigan was given as $41,310,852.20, with a stock issue of $5,450,927.50. Approximately 95 per cent of the stock is owned by the American Telegraph and Telephone Company, according to the report. Rents, interests and matured dividends held by the company are given as $5,709,966.66. The total value of plants and work now in progress is given as $38,987,590.37. The average income a year from each telephone station was $26.63.

Bell Company Buys North Dakota System

The Northwestern Telephone Exchange Company of Minneapolis, in a deal involving $1,000,000 or more, has purchased the lines of the Northern Telephone Company in North Dakota and is negotiating for another line that extends from North Dakota into Montana.

F. H. Stoltze, Minneapolis lumberman and Victor Noble of Minot were the principal stockholders of the Northern Telephone Company. They are reported in Minot dispatches to have received $650,000 for their holdings.

C. E. Yost of Omaha, president of the Northwestern Telephone Exchange Company confirmed the reported purchase and announced that in the making up of its budget for 1916 it had provided for the expenditure in Minneapolis, St. Paul and throughout the Northwest of several millions in betterment and improvement work.

The Northern Telephone Company operates in the district extending from Churches Ferry to Berthold, on the main line of the Great Northern Road, and also along the "Wheat line" of the Soo Railroad, between Kenmare, N. D., and Thief River Falls, Minn. The management is centered at Minot.

Two electric power plants are included in the deal, one at Bottineau and the other at Rugby.

Western Electric's Relation to the Bell System

Reprinted Without Alteration as It Appeared in the Western Electric News

BY H. B. THAYER

IN order to understand the relation of the Western Electric Company to the Bell Telephone System we shall have to get in our minds a picture of the general conditions which led up to that relation.

The beginning of our business was made by the firm of Gray & Barton in 1869. The Western Electric Manufacturing Company was organized in 1872 and took over the business and plant of Gray & Barton and the machinery, etc., of the Western Union Telegraph Company's shop at Ottawa, Illinois. The men who made the new company were Gen. Anson Stager, E. M. Barton and Elisha Gray. Gen. Stager was a capitalist. He was the adviser on business matters of the company and it was he who financed it. Mr. Barton contributed the good management and business sagacity which characterized the following thirty years of his administration. Elisha Gray was an inventor and produced devices which brought considerable profits to the company.

That was before the day of the telephone, the electric light or the electric railway. The commercial applications of electricity were the telegraph, electric call bells and annunciators, fire alarms and other similar uses, most of them in a way related to the telegraph. The company made the apparatus, batteries, insulated wires and supplies which these uses required. The principal product was telegraph apparatus, which up to the time of the company's organization had been largely made by the telegraph company and of which thereafter the company made a part. While there are no available statistics it is probable that at its very beginning the company was the largest manufacturer of electrical apparatus in the country.

THE EARLY MANUFACTURERS.

The aim from the beginning was to make things well. In that period telegraph apparatus was made from castings by instrument makers and in the character of the work and the finish it resembled scientific measuring and testing apparatus. Even in that period of high-class workmanship the quality of the Western Electric Manufacturing Company's product was pre-eminent. At the Centennial Exposition in 1876 five first-class awards were made to the company.

The relations between the company and the Western Union Telegraph Company were very close. It had taken over the work of the telegraph company's western shop. When the telegraph company went into the telephone business in opposition to the Bell interests its claims were based principally on the inventions of Elisha Gray, the superintendent of the Western Electric Manufacturing Company. The telephone apparatus which it used was made in our factory and in its own factory in New York.

The first manufacturing by the Bell interests was in the shop of Charles Williams, Jr., in Boston. Prof. Bell's experimental work was done there and the first commercial telephones were made there.

The American Bell Telephone Company acquired valuable patents on some devices used with telephones and developed the manufacture and sale of telephone apparatus by licensing manufacturers under their patents. The manufacturers so licensed were Charles Williams, Jr., Boston, who made all of the Bell telephones and also some sub-station sets and switchboards; Davis & Watts, Baltimore; Gilliland Electric Manufacturing Company, Indianapolis; Post & Company, Cincinnati; and Electric Merchandising Company, Chicago. Each of whom made subsets and switchboards, but no telephones.

STARTING IN THE EAST.

Now to come back to the Western Electric Manufacturing Company. In 1879 the Western Union Telegraph Company gave up the telephone business and in that same year we took over its New York shop. The effect on us of its giving up the telephone business was the loss of a customer actively exploiting the business. The effect of our taking over the New York shop was to give us an outlet in the East and the shop which had made for the telegraph company in the East the telephone apparatus and telegraph apparatus used by the same class of customers for whom we manufactured in the West. We continued at both shops to make telephone apparatus for extensions of the exchanges which the telegraph company had established and made a gradually increasing amount for the Bell companies.

In 1880 the situation then was as follows: On the operating side there was only The American Bell Telephone Company owning the patents and its license operating companies. The exchanges were growing and being connected by toll lines. The problems of operation, therefore, were becoming more complicated, and better talent in designing and manufacturing apparatus and uniform standards was becoming necessary.

Now as to the manufacturing side. Charles Williams, Jr., was making the telephones in a small shop in Boston. Post & Company were making the sub-station apparatus generally preferred. The Gilliland Electric Manufacturing Company was developing cheap methods of manufacture. E. T. Gilliland was a pioneer, in the electrical business at least, in such methods as using punchings instead of castings. These were the three Bell licensed manufacturers who had up to that time contributed something to the art, and I have mentioned their special contributions. The other manufacturers, excluding the Western Electric Manufacturing Company —and there were several—developed nothing which survived.

INCORPORATION.

Then there was the Western Electric Manufacturing Company with two shops well situated geographically, skilled in the manufacture of telephonic apparatus—either one of them larger and better equipped than any of those of the other manufacturers. With the talent in telephone designing and manufacturing which we had developed in equipment for the Western Union Company and with the type of switchboard best suited to an expanding telephone business, Mr. Vail, then general manager of the American Bell Telephone Company, saw that for the future of the telephone business these elements should be brought together into one strong, well equipped manufacturing organization and that then was the time to do it. As a result of his efforts the Western Electric Company was incorporated in 1881. It took over the business of the Williams and Gilliland shops

and made arrangement which brought in later Post & Company's telephone business.

A contract was made between The American Bell Telephone Company and the Western Electric Company which provided that the manufacturing company should make all of the telephones for the telephone company and that it should be licensed undes the telephone company's patents to make other apparatus for the telephone company's licensees and them only. There was created an obligation upon the telephone company to buy its telephones of the Western Electric Company, but there was no obligation upon its licensees to buy anything of the Western Electric Company. The obvious intention was to create a source of supply for the licensee companies but to leave them free to use it or not. This contract was signed in February, 1882. January 1, 1882, there were in the United States 486 telephone exchanges in operation with 70,525 subscribers. These exchanges were operated by 168 separate organizations, some of them individuals and some of them companies.

SWITCHBOARD PREFERENCES.

The Western Electric Company, therefore, had at the outset 168 possible customers for its products in the telephone field. There were several competitors for the business, particularly switchboards. We obtained our orders through the solicitation of traveling salesmen and by correspondence. During the period immediately after the signing of the contract I had charge of the sales, first in Chicago for two years and after that in New York. I remember very well the difficulties we experienced in getting the business. The company operating in New York City had a strong preference for a type of switchboard known as the Chinnock board made to their order by Bergmann & Company. In and around Albany there was used a type made by the Utica Fire Alarm Telegraph Company. In Philadelphia and St. Louis the Law switchboard was preferred. In Pittsburgh, Cincinnati and Cleveland, one made by C. E. Jones & Bro.; in Providence, one made locally. In Michigan, one made by the Detroit Electrical Works; and in the South, the Law switchboard in the larger cities, and local manufactures in the smaller places.

As I have said, we had good shops and high standards of workmanship. We had intimate relations with the engineers of The American Bell Telephone Company, therefore we knew what the telephone companies required in their service. We had the benefit of the best talent in the country to design the apparatus. We manufactured it well and gave it most careful inspection. We observed it in operation and had the benefit of the experience of the user as well as the maker. We, therefore, gradually made a larger and larger proportion of what was used and as we made more were able to employ more economical methods of manufacture and make lower prices, so that in the course of time we came to make a very large proportion of the telephone apparatus used by the Bell Telephone Companies. So much for the history of the manufacturing relation.

THE SUPPLY CONTRACT RELATION.

The company has always dealt in merchandise not of its own manufacture, suitable for use with its own. In the beginning this was probably more for the convenience of customers than for the direct profit involved. This business grew as the manufacturing business grew and for much the same reasons. We co-operated in the work of standardization. We established good inspection methods. We gave good service and good prices, so that, say twenty years ago, we arrived at a situation in which we were furnishing the Bell companies a large proportion of their requirements of line material and other material not made by us.

About fifteen years ago the relation involved in what we call the supply contract was inaugurated. Assuming a telephone company to be buying 50 per cent of its requirements of us, it was clear that if we could establish an arrangement by which that business would automatically come to us on as favorable terms as the telephone company was getting through its purchasing agent, we would save the telephone company's expense in buying and our expense in selling that material. It seemed probable that the same methods applied to the other 50 per cent would also result in some savings. If we should extend such a plan to several companies we would be able to spread a higher class buying organization over several companies than either company could afford to employ by itself. There would be a more rapid tendency to standardization and therefore to purchases in larger quantities and therefore at lower prices. Carrying the stock and distributing it naturally goes with the buying and a common stock for several companies could be carried and distributed more economically and more efficiently than for one company only. Also it was recognized that buying, storing and distributing material was a subordinate function of a telephone company, but a principal function of a manufacturing company.

IT HAS BEEN AN EVOLUTION.

Taking all of the conditions into consideration there was no escape from the conclusion that there was a chance to accomplish great economies and a greater degree of efficiency by our entering into the relation of purchasing agent for the telephone companies, provided that an equitable arrangement could be worked out. We entered into this relation experimentally with one company fifteen years ago and then with others one by one until after ten or twelve years' evolution of the plan all of the associated companies adopted it. With each the contract was discussed and changes were made to suit their ideas until finally a standard form was arrived at, taking the benefit of all their views and of their and our experience. At first, with the best intentions, we were distrustful of each other. At first we failed to get all of the economies because each party spent too much money in watching the other and we did not get the efficiency because we had not developed far enough our understanding of the telephone company's problem. Gradually we learned how to do the job and very soon we learned that the plan was efficient in proportion to the confidence which each party had in the other and to the extent to which they co-operated.

The relation as it now exists has been an evolution. There have been different forms of contracts but the changes have followed rather than preceded the changes in the relation. At the present time the contract is valuable only as a description of certain routines and methods of settlement. This relation depends for its continuance upon its value to the partners rather than the permanence of a written agreement subject to cancellation practically at will.

WE SELL TO ALL.

In 1907 the American Telephone and Telegraph Company adopted a definite policy of developing and operating in smaller cities and rural districts through locally owned and managed companies with which the Bell Companies proposed to connect. In the fourteen years

which had elapsed following the expiration of the fundamental patent on the telephone, many companies had entered the telephone field and several manufacturers had developed apparatus for their requirements. The Bell apparatus had been designed always with the principle of adaptability to national service in mind and with reference to national standards, while these local companies had required only adaptability to their local requirements. And because there were many of them with no bond of relationship to each other and because there were many manufacturers serving them, there had been no effort at standardization of their apparatus. Therefore, naturally and obviously there was a great difference in their types with each other and with the Bell types.

They could be connected together but not as efficiently and economically as though they had all been designed to work together. It became clearly advisable that such companies as might ultimately connect with the Bell telephone system should have the opportunity to buy the Bell standard apparatus and as there was no way of predicting which companies would ultimately so connect it was decided that all should have the opportunity, and restrictions on this company's sales were removed in October, 1907.

This gives the history of and reason for our third relation to the system, a supplier to the connecting companies.

THE WORTH OF STANDARDIZATION.

As to the present situation. The Bell telephone system consists of twenty-five operating telephone companies covering directly or through connecting companies the whole country. The practice of the Bell telephone system from Maine to California is very largely standardized. Standardization means that to give any specified kind of service on the same day, the same type of apparatus or material is always used, connected up or constructed in the same way. Standards vary from year to year with the improvement in methods, but new standards must always be workable with the old standards. Standardization effects very large economies in construction, maintenance, stock carrying and accounting and in fact all of the activities of a business.

Standardization in the Bell telephone system is accomplished only after much study and labor. First the telephone companies' officials meet a new condition—possibly an apparent demand for a new kind of service. They make investigations to determine whether the demand is real or only apparent. They study the reactions on other types of service and arrive at a conclusion as to whether it is a demand which good service requires should be met. Having so concluded they consider whether it can be met with standard material and methods and find that it requires new material. They then inform us that a piece of apparatus is required to accomplish a certain purpose in a certain way and within certain cost limits. Here our relation to the system as manufacturers begins.

MEETING REQUIREMENTS.

We may then design several alternatives using as many parts of standard types as possible and making full use of all of the experience in the use of materials which we have gained in forty years. The most desirable model is selected and worked into manufacturing form. Samples are made and put through exhaustive service tests and finally something has been produced which the telephone company's officials and we are convinced will meet the requirements efficiently and economically. That is sometimes a long and costly process, but it has to be gone through whether the apparatus is to be used in large quantities or small, and whatever the price is to be; and it is only after it has been done that the piece of apparatus is named a standard for a certain use.

You all know the care with which we select and inspect our raw materials, our tools, our work in process and our finished product. Our customers expect and have a right to expect that when they get our manufactures they can put them in any service for which they are designed and use them with a minimum cost of maintenance and with uniform results. As manufacturer we provide what is wanted of uniform quality and at reasonable cost. For the Bell companies we are officially purchasing agent and storekeeper. In this relation we maintain a large organization to find sources of supply, to study the quality and price conditions and transportation costs, besides actually buying and delivering the material.

THE STOCK PROBLEM.

We receive from the telephone companies along toward the end of the year a rough estimate of the quantities of the principal articles which will be required during the following year. At each of our distributing houses, located at a telephone company's headquarters city, the manager considers himself and the telephone company considers him to be their man. They tell him their plans as fast as they make them. It is up to him with the help and co-operation of the whole company organization to have the material where it is wanted and when it is wanted. That is easy to say but it takes well thought out methods and systems and careful, conscientious work to accomplish it with continual care to keep on the fine line between too much stock and too little stock.

500,000 ORDERS.

We gather their materials from the various factories including our own and distribute them through thirty-four warehouses, which we maintain in the more important cities and distributing centers of the country. We also distribute such material direct from the factory to the place where it is to be utilized, as for instance line material which is shipped often from various factories to points along a line under construction. We fill annually for the companies under this contract about a half-million orders. Some orders call for a single, small item. Some call for big switchboards. There is no way of estimating the value of the efficiency and economy coming out of this relation because since it first went into effect many other improvements have been working toward greater efficiency and economy.

For instance, when the first contract was made the supplies per station of the Bell system were over $8.00. Last year they were less than $1.50. Applying the difference to the total Bell stations would mean a saving in investment of between $50,000,000 and $60,000,000.

Of course, that has not all been accomplished by this relation, *but some substantial part has.* I think that any well informed telephone man would agree with me that the saving in annual expense and annual charges has been very large without making any allowance for a great increase in efficiency. In this way our relation as purchasing agent and storekeeper has grown.

There are about 10,500 telephone companies in the United States; and 5,620 of them were our customers during 1915 for some portion of their requirements. Thus it is that the Western Electric Company has be-

come a supplier to connecting and potentially connecting companies.

AN IMPORTANT FUNCTION.

I could go on and describe the ramifications and details of the work in these relations and give you figures to impress you with its magnitude, but it has seemed to me more important to show you in a more general way that while we perform a tremendously important function in a great national utility—that we are an important factor in it—we have come to that position by doing a good job and then a better job and then still better, so that the telephone companies have each year had more confidence in us and each year have given us a bigger part of the job to do.

A NATURAL RELATIONSHIP.

You will see by what I have said that there is no mystery in the relation between the Western Electric Company and the Bell system. It is a part of the growth of the telephone service and embodies the most practicable relation between the manufacturing and operating departments of a service which has developed faster and fills a larger field and is more universal in its relation with the public than any other. The development of telephone service to give the greatest benefit to the public required such a relationship as has existed and does exist between us and the operating companies.

In a new field and to a certain extent in any field, the invention is only a starting stake in a long race. It is rarely complete or even ready to perform service, and not only must the invention itself be made workable, but auxiliary apparatus and facilities must be developed. Following the telephone came the whole field of telephonic development, the subscriber's station, the central offices, the connecting lines and subways with all the multiplicity of pieces and devices. These all had to be developed on right lines. Suggestions for improvement do not always originate in the laboratory or in the minds of inventors. They come from the machinist who is building or assembling the apparatus or from the operator who is handling the service, and in the laboratory and workshop they must be all co-ordinated and fitted into each other and there must be common control and common operation to get the best or even effective results.

Community of interest in corporations is something like blood relationship in individuals. If both parties are disposed to co-operate they get rather closer together than strangers ever do, but if either party falls short in the spirit or acts of co-operation they get farther apart than strangers.

Never get the impression that any part of this job belongs to us and cannot be taken away. It is a good thing for both parties now because both parties are efficient and they co-operate. Whenever either party becomes inefficient and there is no longer co-operation the relation will terminate.

The Western Electric Company is the workshop of the Bell system and the Bell service is the most effective in the world. That relation has contributed to make the Western Electric apparatus the model for the telephone systems of the world. Our efficiency is reflected in the telephone service and the efficiency of the telephone service is reflected in our apparatus.

We are all proud of the company, proud of what it has done and what it is doing; proud of its methods and proud of its men. We must go on doing better work each year and that means that each man and woman must take pride in doing his or her part the best that it can be done, and we who have the responsibility for distributing the rewards for good service must use all of our judgment to see that they go where the merit is.

Telephones to All Parts

Communication being as urgent as transport, the Royal Engineers of England have seen to it that the large area of northern and north-west France in which the armies are operating has been linked up by a telephonic system unique. It is no mere collection of temporary wires strung from tree to tree. The poles and wires are in every way as good as those of the post office at home. The installation might indeed be thought to be extravagant, but cheap telephoning is notoriously bad telephoning. A breakdown of communications which might be caused by the fierce wind and electric storms which have happened so frequently in the war might spell a great inconvenience or even worse. An indistinct telephone is useless. And so, marching with the army, and linking up a thousand essential points, is a telephone service that cannot be bettered. Today it would be quite possible for the commander-in-chief, if he so desired, to call up London from beyond Fricourt, for wires are already in places where we saw them burying the blackened corpses of dead Germans, and where the sound of great guns makes it sometimes necessary to shout in order to make oneself heard in a conversation.

Every officer or head of department of importance in the British zone has a telephone at his hand, so that he may give and receive orders, not absolutely secret, by the quickest and most popular means of communication. Where necessary, the English telephones are linked up with the trunk lines of the French government, for which purposes interpreters are placed in the exchanges. The speed of communication is remarkable. It varies, of course, with the amount of business, but I have seen a man call up Paris, London and the seaport bases in France all within an hour.

Supplementing the telephonic system is a telegraphic link, and there is also the wireless. The army signal corps is to be congratulated on a fine achievement. Over and above these there are the motor dispatch riders, some of whose experiences during the war have been as thrilling as those of our air boys. The noisy nuisance of peace time roads at home has been a prime factor in the prompt waging of war. Motor cycles and portable telephones appear in the most out of the way spots. Far beyond Fricourt I met these cyclists making their way in and out and around the shell holes.—Lord Northcliffe in *The London Times.*

Telephone Business in New Brunswick

Consul Edward A. Dow, St. Stephen, New Brunswick, Canada, says the annual report of the New Brunswick Telephone Company shows a gain of 912 telephones and a gain of $9,500 in annual toll receipts for the fiscal year ended March 31, 1916. Other features noted in the report are the increase of from 50 to 100 per cent in the cost of wire, cables, and hardware, and scarcity of labor on account of enlistments in the army. The assets are reported as $1,980,515 and surplus $24,737. The gross revenue was $482,287, from which operating expenses and depreciation were deducted, $364,676, leaving a net revenue of $117,611. Dividends paid during the year amounted to $100,764, and the capital stock was $1,259,540.

Inductive Interference as a Practical Problem

Presented Before the American Institute of Electrical Engineers at Seattle, Wash.

BY A. H. GRISWOLD AND R. W. MASTICK

In this paper are given a review of the factors which affect inductive interference in telephone circuits from high voltage power transmission circuits, a presentation of the practical considerations regarding the reduction of the interference, and a description of actual cases of the application of these means of reduction.

Distinction is made between the effect of balanced and of residual voltages and currents on the power circuit and between the effect of voltages induced between the wires and those induced between wires and ground.

The wave shapes of the voltages and currents in the power circuits have a very important effect in the amount of inductive interference in telephone circuits. The precision of the electrical balance of the power circuit is also important because of the relatively very large effects of unbalanced voltages and currents in producing inductive interference.

A discussion is given of the principles to be used in the design of co-ordinated transposition schemes for power circuits and telephone circuits which parallel each other, and schemes are described which have been devised for application to the telephone circuits in order to simplify the design of transpositions in the power circuits which make it possible to balance the induced voltages.

A detailed discussion is given of three particular cases of parallels showing the application to them of the different methods by which inductive interference can be reduced. In the Appendix is an outline of information regarding parallels intended to facilitate the determination of the remedial measures desirable in any given case for reducing inductive interference.

DISCUSSIONS of the subject of inductive interference hitherto presented before the Institute and in the technical press, have dealt chiefly with the technical aspects of the problem. Very little has been said to show how the conclusions theoretically and experimentally established can be practically and successfully employed for the solution of problems in the field. It is the purpose of this paper to review some of the important aspects of inductive interference and to indicate by means of concrete examples, the solution of some of the practical problems met in the field. It will be our endeavor to show the simplicity of remedial measures in general in an effort to correct the idea prevalent among those who have not had time to carefully study the problem, that the measures developed to date are impracticable and burdensome.

Before proceeding to the discussion of remedial measures and their application, we believe it well to again review briefly, the factors involved, through which inductive interference arises. An understanding of these factors, and their relative importance, is necessary in order to appreciate the significance of the remedial measures.

In what follows, three-phase three-wire power circuits and metallic telephone circuits, physical or phantom, are assumed. We are concerned with voltages induced in the telephone circuit through two phenomena—electric and magnetic induction. Both effects are always present, and they combine to produce the resultant disturbance noted.

The voltage induced in the telephone circuit electrically and magnetically can be classified as:

1. Between the two sides of the circuit (referred to throughout this paper as the transverse effect).
2. Between the two sides of the circuit and ground, or along the circuit (referred to throughout this paper as the longitudinal effect).

The transverse induced voltages regulating through line impedances cause currents in the terminal apparatus. The longitudinal induced voltages, in addition to raising the telephone circuit to a potential with respect to earth which may be dangerous, cause currents in the telephone circuit owing to the differences in series impedances and admittances to ground of the two sides of the circuit.

A perfectly balanced power or telephone circuit may be defined as one in which the series impedancies of the several phases and the admittances between the several phases and ground are exactly the same at every point.

If it were possible to construct a perfectly balanced telephone circuit, there could be theoretically no transverse induced voltage, regardless of the magnitude of longitudinal induced voltage provided that a sufficiently large number of exactly spaced transpositions were placed in it so as to equalize the induced voltages in each side.

Conversely, if it were possible to construct a perfectly balanced power circuit, there could be theoretically no voltages induced on a parallel telephone circuit, provided that a sufficiently large number of exactly spaced transpositions were placed in it so as to expose each phase of the power line equally to the telephone line throughout its length.

In practice, the balance of neither power nor telephone circuits can be made perfect as defined above, and it is, therefore, necessary, in order to avoid induction into paralleled telephone circuits, to balance both power and telephone circuits as well as practicable, and also transpose both circuits with due regard to one another.

It is convenient to consider the voltages and currents in the power circuits, which cause induction, as consisting of two components:

1. Balanced voltages and currents.
2. Residual voltages and currents.

The balanced components are three voltages or currents equal in magnitude, displaced 120 degrees in time-phase with respect to one another, and whose vector sum is, therefore, zero.

Single-phase loads connected between wires cause voltage and current components whose effects are very similar to those of balanced three-phase voltages and currents, and are treated in a like manner.

The residual components are three voltages or currents equal in magnitude, in common time-phase, and whose vector sum is, therefore, not zero.

The balanced voltages and currents are those which perform the useful functions of the power system. On the other hand, it is significant and fortunate that the residual voltages and currents are not essential to the operation of the power system.

Balanced voltages and currents are common to either of the two general types of power systems (grounded or isolated), and the remedial measures for the mitigation of inductive effects arising therefrom are

identical. This is not true of the residual voltages and currents. These arise from different sources in the two types of power systems, and generally exhibit characteristics peculiar to the particular type of system.

The remedial measures for their mitigation are also distinctly different.

Thus, it will be seen that there are two different phases of the general problem of inductive interference, *i. e.*,

1. The mitigation of induction arising from the balanced voltages and currents, requiring remedial measures which are the same whether the power system be isolated or grounded.

2. The mitigation of residual voltages and currents requiring remedial measures peculiar to the particular type of power system involved.

Residual voltages and currents may arise in different types of power systems from one or more sources which act singly or together.

On grounded systems, the principal sources of residual voltages and currents are:

1. Unbalanced loads between the three-phase and neutral, causing unbalanced-load currents to flow through the neutral to earth.

2. The third harmonic and its odd multiples, due to a variation of permeability of the iron, occur in common time-phase in the three phases of the transformer banks, thus giving rise to a residual component of voltage and current in the connected transmission lines.

On systems isolated from ground, the principal source of residual voltages and currents is:

Unbalanced capacitance and conductance between the several phases and ground. The conductance factor is generally of minor importance on well constructed and maintained systems.

The tendency in the best power systems design and operation is inherently toward practices which reduce the possibility of large residuals. Moreover, the majority of the future parallels with communication circuits will undoubtedly be short, owing to the increasing tendency of both power and telephone companies to seek private rights-of-way. Were this not so, the problem of mitigation of residuals would be as difficult to combat in the future as it is at present. With the increased attention being devoted to this matter we expect that the longitudinal effects of residual voltages and currents will, in the shorter parallels, be reduced to magnitudes small enough to be relatively unimportant.

It must be realized that the inductive effect per volt or ampere of residual voltage or current is proportionately far greater than for equal amounts of balanced voltage or current. It should be clearly understood that the mitigation of residuals where parallels of considerable length are involved is of great importance. The longitudinal effect then becomes of importance by maintaining the telephone circuit as a whole above ground potential and producing a transverse effect by virtue of the unbalances inherent to commercial circuits.

The wave-forms have much to do with the severity of induction. Higher harmonics are present in both voltages and currents and their power of producing disturbances increases with very great rapidity up to about 800 cycles. Practically all noise in telephone circuits caused by induction from power circuits arises from the higher harmonic voltages and currents. Were these entirely absent, the problem of inductive interference would be indeed simple of solution, for then we should have to deal with only the fundamental frequency which is of slight effect and scarcely audible to the human ear.

The frequency and magnitude of these attendant harmonics should determine the extent of remedial measures to be applied owing to the variation in effectiveness of given remedial measures and severity of induction with the frequency.

Another important phase of the problem is the question of abnormal conditions, accidental or otherwise, on the power system. An abnormal condition in any type of power system, whether is be due to an accidental ground, short circuit, open-circuit or switching operation, produces a great increase in the residual voltage or current, or both, of the system momentarily, or for a considerable period of time, as the case may be.

On a star-connected grounded-neutral system, an abnormal condition generally produces a large residual current which is approximately equal to the short-circuit current to ground (if the condition be one of a grounded phase) on that portion of the circuit between the sources of power supply the fault and the point where the fault occurs, or if the fault be an open one in phase, the residual current will equal the unbalanced-load currents flowing in the other two phases. A residual voltage is created in proximity to the fault and in certain instances throughout the length of the circuit from the fault to the receiving transformers, which voltage approaches as a maximum 58 per cent of the voltage between phases.

On an isolated system, a ground on one phase causes a large residual voltage throughout the entire length of the circuit whose magnitude is 173 per cent of the voltage between phases. A residual current is created in proximity to the fault, its magnitude depending upon the extent, voltage and frequency of the system.

Fortunately, abnormal conditions are becoming less frequent, owing to the demand for greater continuity of service, leading to better construction of power lines and to the use of better apparatus. There have been no remedial measures developed which can adequately care for the inductive disturbances attendant to abnormal conditions of power lines, nor are such expected.

It is, therefore, a question of reducing to a minimum the accidents on the power lines by proper construction and maintenance and of using methods and apparatus in switching which shall incur the least possible disturbances.

The difficulties encountered in attempting to mitigate the disturbances under abnormal power circuit conditions constitute an additional reason why it is very desirable to avoid parallelism wherever possible.

As an instance in which the use of improved methods and apparatus have resulted in a material reduction of transient disturbances, the charging of electrolytic lightning arresters can be cited. Since the adoption of the four-tank electrolytic lightning arrester, the use of charging resistances, and metallic contact during charging, the formerly serious transient disturbances experienced on parallel telephone lines at times of charging, have been largely reduced.

The configuration and spacing of the power-circuit conductors has an important bearing on:

1. The liability to short-circuits on the line.
2. The residual voltage (of an isolated system).
3. The resultant induction from balanced components.

Since the last two items can be cared for by transposition, the first is of chief importance.

Vertical configuration of a power circuit renders it

liable to short-circuits where snow and sleet are encountered.

The equilateral triangle is far superior to either vertical or flat construction with respect to residual voltage caused by capacitance unbalance. The wishbone configuration is intermediate. For induction from balanced components, the differences are less marked, the flat configuration causing the most induction.

The configuration of telephone circuits is standardized to a far greater degree, and since transposition is comparatively inexpensive and effective, the configuration of telephone circuits is relatively unimportant with regard to the mitigation of induction.

For the mitigation of inductive effects produced by the balanced voltages and currents, transpositions offer the most feasible, simple and effective means developed to date. A transposition in a circuit interchanges the positions occupied by its conductors. In a three-phase power circuit, a transposition changes the phase of the induction produced by the balanced voltages and currents by 120 degrees. Thus, by locating power-circuit transpositions so that each conductor occupies all of the several conductor positions for equal distances, a "barrel" is obtained within which the vector sum of the induced voltages on an untransposed parallel circuit is zero. The effect of transposing a power circuit may, therefore, be said to be one of neutralization.

A transposition in a telephone circuit changes the phase of the induced transverse voltage by 180 degrees, that is, it reverses in successive lengths the phase of the induction between the two sides of the circuit. Transposition of a telephone circuit, therefore, exposes each side

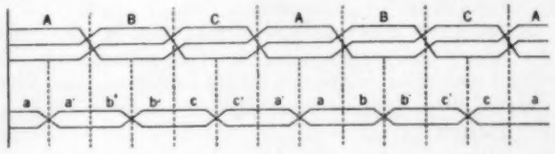


Fig. 1.

of the circuit equally to the influence of the power circuit, and the effect may be said to be one of equalization. It should be noted that the phase of the longitudinally induced voltage is in no wise changed by transpositions in the telephone circuit.

This change of phase of the induction into a telephone circuit by transposition in either the power or telephone circuit, or both, affords a means of reducing inductive effects in that the induction in one section may be largely neutralized by the induction in neighboring sections.

A proper adjustment of neutralization and equalization effects by transpositions in both power and telephone circuits constitutes a "co-ordinated transposition scheme" as referred to throughout the remainder of this paper.

In Fig. 1 is shown a co-ordinated transposition scheme in the case of a three-phase power circuit and a simple metallic telephone circuit. Let the three configurations of the power circuit be designated A, B, C. Let a and a' denote the length of telephone circuit, exposed to configuration A; b, b' and c, c' are similarly defined. Primes denote that there is an odd number of telephone transpositions between the given length and the reference section of the telephone conductor. For balance to induction the lengths a, a', b, b', c, c' must fulfill the relation

$$\Sigma a = \Sigma a' = \Sigma b = \Sigma b' = \Sigma c = \Sigma c'$$

Longitudinal induction balance for balanced voltages and currents is obtained when the condition

$$\Sigma (a + a') = \Sigma (b + b') = \Sigma (c + c')$$

is fulfilled.

Transverse induction balance for balanced voltages and currents is obtained when the condition

$$\Sigma (a - a') = \Sigma (b - b' =) \Sigma (c - c')$$

is fulfilled.

The system of "barreling" shown in Fig. 1 is called "continuous barrelling." In practice where long uniform parallels occur, it is possible and many times desirable to modify the co-ordinated system shown in Fig. 1

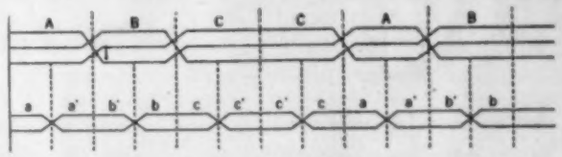


Fig. 2.

by omitting every third power transposition as depicted in Fig. 2, thus obtaining a system of "non-continuous barrelling."

The same conditions for balance hold for this system as given for continuous barrelling shown in Fig. 1. The only advantage of continuous barrelling over non-continuous is that balance is obtained in any three consecutive sections regardless of the point of starting.

Power circuit transpositions with reversed rotation are sometimes used when it is necessary to obtain an exposure of a particular phase in a particular section to balance with another type exposure in some other section of the parallel. A simple illustration is shown in Fig. 3.

It is interesting to note that the use of reversed power transpositions in the manner shown also results in not altering the relation of power wires at ends of the parallel. Reversing the rotation of a power circuit transposition changes the phase of the induction in the section of parallel immediately beyond the transposition by 240 degrees. Since a telephone transposition changes the phase of the induced voltage by 180 degrees, it is obviously immaterial whether the rotation of telephone transpositions be normal or reversed. Normal rotation is considered as that of the existing transpositions in a given power line.

Transpositions of the power circuit in no way changes the phase or magnitude of induction produced in telephone circuits by residual voltages and currents, except in so far as it changes the residual voltages and currents themselves, which happens in some cases.

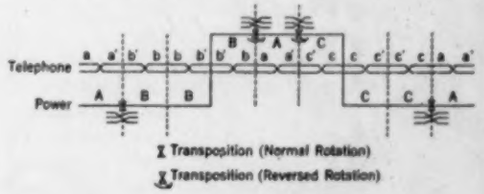


Fig. 3.

Longitudinal induction from the residual voltages and currents cannot be reduced by either power or telephone transpositions. It follows, therefore, that the reduction or elimination of longitudinal induction from residual voltages and currents must come about through a reduction or elimination of the residuals themselves in the power system.

Transpositions of the telephone circuit is an effective means for reducing the transverse induced voltage produced by residual voltages and currents.

Transverse balance for induction from residual vol-

tages and currents is obtained when the condition (see Figs. 1, 2, or 3)

$$\Sigma(a+b+c) = \Sigma(a'+b'+c')$$

is fulfilled.

When the conditions for balance cited above are not fulfilled the unbalanced exposures are as follows:

TABLE I.

Type of Induction	Component of power circuit voltage or current	Length of unbalanced exposure
Transverse	Balanced	$\Sigma(a-a')/\underline{0}^\circ + \Sigma(b-b')\ /\underline{120}^\circ + \Sigma(c-c')\ /\underline{240}^\circ$
"	Residual	$\Sigma(a+b+c) - \Sigma(a'+b'+c')$
Longitudinal	Balanced	$\Sigma(a+a')\ /\underline{0}^\circ + \Sigma(b+b')\ /\underline{120}^\circ + \Sigma(c+c')\ /\underline{240}^\circ$
"	Residual*	$\Sigma(a+b+c+a'+b'+c')$

*Independent of all transpositions.

The "unbalanced exposure" is the length of exposure between untransposed telephone and power circuits which will produce inductive effects of the same magnitude as those produced in the actual exposure of the same configuration with the given transpositions in telephone and power circuits.

The unbalanced exposures of different circuits in any given parallel are of value to indicate the relative severity of the induction in the different circuits, and those corresponding to different transposition systems for a given parallel are indicative of the relative effectiveness of such transposition systems.

Summing up from the discussion above; the various factors involved and the conditions for induction balance between power and telephone circuits may be simply tabulated as follows:

TABLE II.

Type of Induction	Component of power circuit voltage or current	Condition for balance	Balance depends on transpositions in
Transverse	Balanced	$\Sigma(a-a') = \Sigma(b-b') = \Sigma(c-c')$	Both lines
"	Residual	$\Sigma(a+b+c) = \Sigma(a'+b'+c')$	Telephone line
Longitudinal	Balanced	$\Sigma(a+a') = \Sigma(b+b') = \Sigma(c+c')$	Power line
"	Residual		

The application of telephone transpositions in a manner to obtain the conditions for balance indicated in Table II is subject in practice to the condition that on telephone leads carrying more than one circuit, it is necessary to provide against induction from one telephone circuit into another, commonly referred to as "crosstalk." This necessitates a complicated telephone transposition system to provide balance for induction from outside sources such as power lines and also among all the circuits on the telephone lead.

Even though it were possible in practice to fulfill exactly the conditions for balance as indicated in Table II, there would still be present some inductive effect because of the changes in phase and magnitude of the voltages and currents along the power line. This point has an important bearing on the length of power-circuit barrel, for it is necessary in order that this effect be rendered sufficiently small, that the conditions for balance outlined in Table II be fulfilled within as short a length of exposure as is practicable. In practice, it has been found, in some cases, that barrels in the power circuit six miles in length are satisfactory. Except under very severe exposure conditions we believe that barrels in the power circuit three miles in length will afford a satisfactory solution when uniform sections of parallel are long enough to permit their use.

Points of discontinuity within a parallel, such as changes in configuration of either power or telephone circuit, large changes in the separation of the two lines, crossovers, branch loads, loading points in the telephone line, or in fact any points at which an abrupt change in magnitude or phase of the power line voltages or currents or induced voltages occurs, should in general be made neutral points. In other words, balance to induction should be obtained between such points of discontinuity independently of the remainder of the parallel. Thus the number of and distance between points of discontinuity is a controlling factor in determining the length of power-circuit barrel. It should be noted in this connection that a loading coil in the telephone circuit is a discontinuity with respect to the transverse induced voltage, but not with respect to the longitudinal induced voltage, since the loading coils are non-inductively connected in the circuit formed by the telephone wires and ground.

Crossovers of power and telephone lines within the parallel are in general considered as points of discontinuity. In some cases, however, where the same separation obtains between the power and telephone lines before and after crossover, it is possible by interchange of the pin positions of the power wires to make the crossover equivalent to a transposition in the telephone circuit, or in both the power and telephone circuits. If the crossover is treated in such a manner, it need not be considered as a point of discontinuity.

In Fig. 4 are shown several types of crossover transpositions represented by the terms "0° crossover," "120° crossover" and "240° crossover" which number of degrees has reference to the change in phase of the longitudinal induced voltage between the two sections immediately adjacent to the crossover.

It has been previously pointed out that transposition of the telephone circuit is an effective remedy for reducing the transverse induction from residual voltages and currents; that longitudinal induction from the same source cannot be cared for by either power or telephone transpositions, hence must be reduced by a reduction of the residual voltages and currents within the power system.

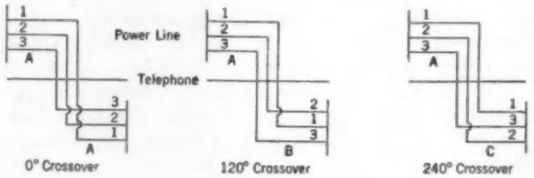


Fig. 4.

In the type of power system isolated from ground, the problem of reducing residual voltages and currents is a comparatively simple one. Earlier herein it was stated that the principal source of residual voltage and current in systems isolated from ground is the unbalanced capacitance between the several wires of the circuit and ground. Hence the remedial measure obviously necessary is a balancing of these capacitances to ground. This is most readily accomplished by transposing the power line throughout its extent (including all the lines metallically connected to the one in the parallel) so that each conductor occupies the several pin-positions for equal distances.

To a company operating an isolated system of large extent, this remedy appears to be a severe and costly measure, unless very few and widely separated transpositions will accomplish the desired result. In general, practice indicates that transpositions for this purpose can

be relatively and widely separated. Here again in determining the length of barrel required, the wave-shape of the residual voltage is a dominant factor, since with the higher frequencies shorter barrels are necessary.

It does not seem probable that barrels of less than 6 miles in length will generally be required and in some cases longer barrels will be sufficient. Branch lines, switching points and changes of configuration must be taken into account and frequently fix the length of barrel.

In the construction of new lines, it is a very simple and inexpensive matter to cut in transpositions at reasonable distances to accomplish the reduction of residual voltage without detriment to the operation of the system. Then if parallelism occurs in the future, the only transpositions required would be in and near the parallel.

With existing parallels, it may or may not be necessary to transpose the power line outside the barrel, depending upon the severity of the exposure. In any event, all of the measures should be applied within the parallel and found insufficient before giving consideration to this point.

In the type of power system operated with a star connection of transformers and grounded neutral, the reduction of residual voltages and currents is not so readily accomplished as in the case of systems isolated from ground. Two principal sources of residual voltages and currents for this type of system have been previously mentioned herein; namely, unbalanced loads between the three-phases and neutral, and the introduction of the third harmonic and its odd multiples as residuals.

The obvious measure against the former is the removal of all grounded neutrals but one, thus removing the ground path for the unbalanced currents. In some cases this may not always be considered safe or feasible, particularly if the network be of large extent. There seems to be, however, a growing tendency on the part of power companies operating systems of large extent toward the elimination of the ground connection at all but important generating and switching points. Since the use of grounded sinngle-phase loads has almost disappeared from practice with the larger power companies, it is now generally true that power circuits operated by such companies can be very well balanced as to magnitude of load current in the three phases and the unbalanced load current can usually be practically eliminated.

The introduction of the triple harmonics as residual voltages and currents is the chief problem of the grounded neutral system. Since these triple-harmonic voltages and currents are introduced through the effect of variable permeability of iron in transformers and as their magnitude is directly dependent upon the magnetic density at which the transformer is operated, this type of residual is reduced by operating the transformers below their rated voltage. There is no doubt that the practice of operating transformers over rated voltage is the cause for the large residual current of triple frequencies obseved on star-connected systems, since the magnitude of these harmonics increases very rapidly as the transformer iron approaches magnetic saturation.

The employment of the delta-star connection of transformers on grounded systems is greatly preferable to the star-star connection, in that the delta winding provides a low impedance path for the triple harmonics, in parallel with the path provided by the line and earth, hence reduces the magnitude of such currents over the line and earth path.

It is difficult to accurately predict on systems employing the star-delta type of connections whether or not the magnitude of triple harmonic residual will be large enough to cause severe inductive effects, since it depends upon a multitude of considerations dealing with the interaction of different portions of the system one on another.

In the case where both star-star and star-delta banks are used, the line sides being in star with grounded neutral, the star-delta bank offers a low-impedance path for the triple-harmonic magnetizing currents of the star-star bank. Hence in the line, between two such different banks, there will be a large residual current, and an exposure occurring there is liable to serious induction. Such a star-delta bank may, however, be used as a shunt path for the triple-harmonic residuals, and greatly reduce their magnitude in the line beyond. Thus, a remedial measure is suggested for the mitigation of triple-harmonic residuals on systems employing the star-star connection.

The triple-harmonic circulating current of the delta winding is greatly increased where such connection is used in combination with star-star banks and hence a star-delta bank of size comparable with the star-star bank is required to give effective results.

On a system employing only the star-star connection of transformers with grounded neutrals, it is always a safe prediction that serious triple-harmonic residuals will be present, and it is essential that measures for their reduction be considered. Tertiary delta windings on such transformers are beneficial and new transformers for proposed installations of this connection should be designed to provide such windings. Power engineers recognize the advisability of providing such windings for their own benefit when using this type of connection so that much of the trouble formerly experienced will thereby be eliminated in the future.

The interconnected-star is a method of reducing triple-harmonic residuals by neutralization. Besides being less efficient than the star-delta connection, it reduces the voltage rating by 13 per cent and requires a more complicated arrangement of the wiring.

It will be seen from the above discussion of the mitigation of residual voltages and currents under normal operating conditions, that:

1. In isolated delta-connected systems, residuals may be effectively and easily reduced by simple means.
2. In star-connected grounded systems, several measures can be practiced for reducing residuals all of which will reduce them with some degree of success but none of which are entirely satisfactory.

Types of power-circuit transpositions and barreling have been described previously and their application to the practical case will be readily understood. In the case of telephone transpositions, only a single metallic circuit has been considered in the discussion of the co-ordination of transpositions, without reference to cases where more than one telephone circuit is involved other than to mention the fact that the problem was further complicated.

For the application of co-ordinated systems of power and telephone transpositions to the practical case, a telephone transposition system has been designed which will care for as many as forty telephone wires (20 physical and 10 phantom circuits), providing adequate crosstalk balance between the telephone circuits themselves and being capable of properly co-ordinating with power-circuit barrels of varying lengths. Further work is in progress which will extend this system to a full eighty-wire lead.

This system is known as the "exposed line system." It is comprised of two types of sections as follows:

1. Exposed line *A* section.
2. Exposed line *X* section.

Additional short sections, whose characteristics have not, as yet, been determined, are in the process of development; namely, the exposed line *Y* and *Z* sections.

The exposed line *A* section is nominally eight miles in length with 32 transposition points for the circuit most commonly used, and has been designed to give high crosstalk-balance together with induction balance to power lines transposed:

1. Opposite any mile-points of the telephone transposition system.
2. With two complete barrels (five transpositions of the power line) between mile-points of the telephone transposition system.

Thus, for a uniform parallel, this section gives balance to induction from power lines transposed with six-mile, three-mile or one-half mile barrels. It is possible to adjust the length of this nominal eight-mile section to any value less than eight miles, and this is frequently done in adjusting the sections or mile-points to correspond with discontinuities in the parallel. Transverse balance of all circuits to induction is accomplished in every mile.

The exposed line *X* section is nominally one-half mile in length with four transposition points, and is so designed that any number of units may be installed end to end. The *X* section unit does not balance to power lines transposed within any one unit, but is designed to be so used that transpositions of the power line and discontinuities of the exposure occur at junction points between successive units. Thus balance to induction is obtained in three successive sections if power transpositions are located opposite their junction points. Nominally this would give a power circuit barrel of one and one-half miles. The *X* section can be made of any length less than one-half mile per unit where required.

Short exposed line sections may be used in any part of an eight-mile loading section, and the remainder transposed according to some other transposition system.

By "other transposition systems," reference is made to the "standard system" which involves the use of four sections, *A*, *X*, *Y*, and *Z*, whose nominal lengths are 8, ½, 1½ and 4 miles respectively. In the standard system, however, balance to induction from outside sources, such as power lines, is not obtainable except by modification of certain of the transpositions involved. Also, the use of the *X*, *Y*, or *Z* sections consecutively is not permissible without modification.

Another method sometimes used is to superimpose on the cross talk transposition systems, already in the line, special transpositions of all the telephone circuits on poles between the regular transpositions poles. That is, their function is to transpose all circuits with reference to outside circuits so as to give a minimum of disturbance to the crosstalk balance of the telephone circuits themselves. The prime purpose of "whole-line" transposition is, therefore, to make possible the retention of systems of transposition involved in parallelism which do not provide balance to induction in themselves. The use of whole-line transpositions is limited by crosstalk considerations to some extent where phantom or loaded circuits are involved. Their chief application is to very short parallelisms.

There are two types of whole-line transpositions; namely, the quarter-mile unit and half-mile unit. These are shown in Fig. 5.

The use of short sections or whole-line transpositions is deleterious to the telephone service in that it is impossible with these arrangements of transpositions to reduce cross-talk as effectively as with eight-mile sections. Moreover, the difficulty of maintenance of telephone service is increased.

In order to illustrate in a more comprehensive manner the application of remedial measures, such as have been described and discussed in the previous sections of this paper, a few concrete examples will be cited and their solutions discussed. Before doing this, however, we believe it well to call attention to the fact that the successful design of remedial measures necessitates an exact knowledge, on the part of the engineer, of many details of the particular case. Not only must he be thoroughly conversant with the telephone circuits involved, but he must also be conversant with the characteristics of the power system involved. It is highly desirable that a personal inspection be made and copious notes taken in order that all practical difficulties be observed in advance of the design of remedial measures. That it is not possible for the engineer to personally inspect every case is recognized, hence the data must oftimes be collected by some other person, and it is, therefore, necessary that a procedure be devised for presenting an accurate and detailed report to the engineer for his guidance.

Through the courtesy of the Pacific Telephone and Telegraph Company, we present in Appendix I of this paper the pertinent part of an engineering circular, describing a procedure for surveying a case of parallelism and for transmitting an accuate account of the essential facts, which we have found exceedingly satisfactory.

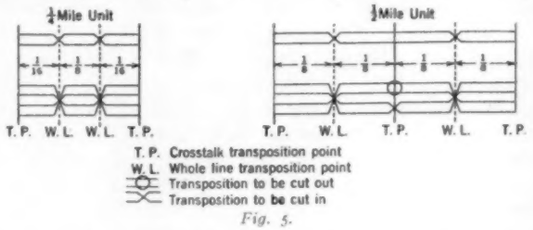


Fig. 5.

In the examples which follow, the symbolic representations described in Appendix I are used, and the reader is referred to this Appendix for their explanation.

The foregoing text has emphasized the fact that the severity of requirements of transpositions and balance which must be imposed on the circuits in a parallel depends largely on the wave shape of the generating apparatus as well as on the fundamental frequency of the power system and on other local conditions. This fact has been taken into account in the examples given below. In cases II and III the number of transpositions in the power circuits is less than would in many cases give satisfactory results, but in case II represents an arrangement which was applied with success, and in case III, one which it seems reasonable to install, in a particular case which has arisen.

CASE I.

Case I presents an example of a uniform parallel involving three power circuits (see illustration) whose parallelism is coincident for a little over half of the total parallel. The case was presented for solution as a practical problem in the field, and the remedial measures are to be described have been installed in part and found effective. The details of the parallel and characteristics of the power lines and telephone system are as follows:

Power Systems. No. 1. 30,000 volts, three-phase,

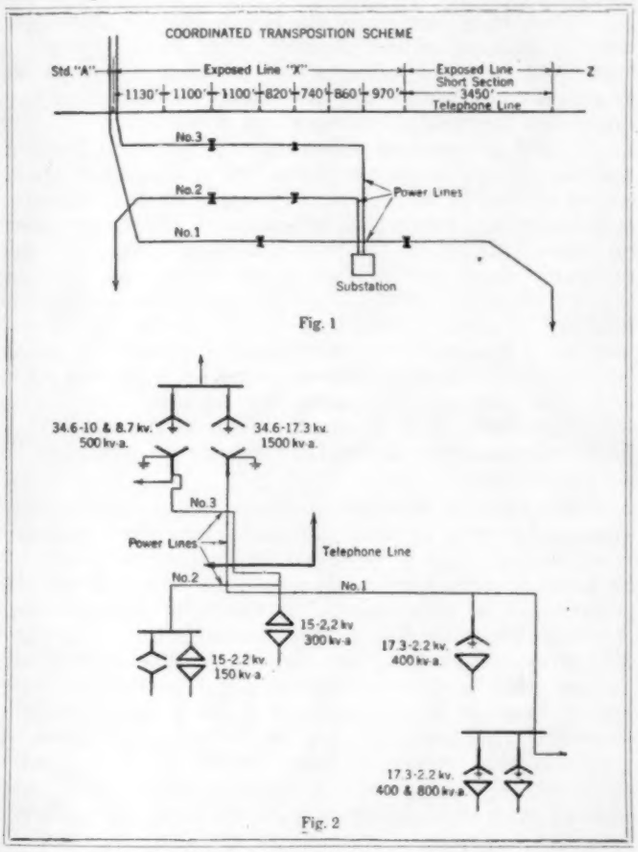
50 cycles, vertical configuration; tower construction; star-star connected and star-delta connected transformer banks employing a ground connection. No transpositions.

No. 2. 15,000 volts, three-phase, 50 cycles. Flat configuration; pole construction; star-star connected transformer bank supply with grounded neutral and delta-delta and star-star (isolated neutrals) connected load banks. No transpositions.

No. 3. 15,000 volts, three-phase, 50 cycles. Triangular configuration; pole construction; star-star connected transformer bank supply with grounded neutral and delta-delta connected load banks. No transpositions.

Telephone System. High-grade loaded physical and phantom long distance circuits; ultimate capacity of lead 40 physical and 20 phantom circuits. Standard system of transpositions.

Parallel. 10,170 feet in length; separation of power and telephone leads: No. 1, 75 feet; No. 2, 49 feet; No. 3, 18 feet. Crossover at beginning of parallel circuits No. 1 and No. 3.



Case I.

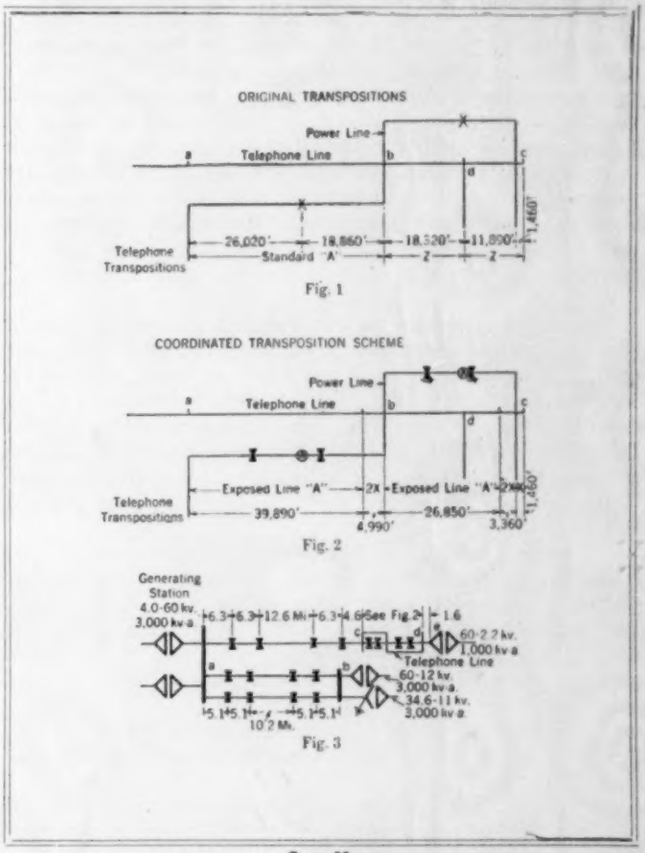
Co-ordinated Transposition Scheme. The variation in length of parallelism of the three power lines, different separations from the telephone line, difference in voltages, configuration and transformer connections as indicated above and on Case I, coupled with the added fact that the parallel is short and located in the middle of a telephone loading section which could not be disturbed as to length, makes this case a very interesting example of transposition-coordination and residual-mitigation.

Short transposition sections of the exposed-line type offer the most feasible solution and the co-ordination was accomplished as follows:

Considering power circuit No. 1, one barrel within the exposure was deemed sufficient to accomplish satisfactory longitudinal balance to the balanced voltages and currents. Hence the section of power line involved within the parallel is divided into three equal sections by the installation of transpositions therein at the towers adjacent to the one-third and two-thirds points.

Circuits No. 2 and No. 3 are operated in parallel and their exposures to the telephone line are coincident, hence accomplishing longitudinal balance by means of one barrel in each circuit within their exposure is feasible. Therefore, the length of parallel involving these circuits is divided into three equal sections by transpositions installed in the two power circuits at the one-third and two-thirds points.

Transverse balance to induction from both the balanced and residual voltages and currents is accomplished by using exposed line *X* sections of such length that their junction points fall opposite the power-circuit transpositions as depicted in Fig. 1 of Case I. From a point opposite the second transposition in power circuit No. 1 to the end of the parallel, a *"Y"* section is used since no discontinuities intervene to require shorter sections.



Case II.

Mitigation of Residuals. The mitigation of residuals for this case brings out some interesting features. Considering Circuit No. 1 (see Fig. 2, Case I), a combination of star-star and star-delta connected transformer banks, with grounded neutrals is employed. As pointed out in a previous section of this paper, a condition is here established which is conducive to the passage of large triple-harmonic residual currents over the power line past the exposure with consequent heavy longitudinal induction on the telephone circuits. The obvious measure for reducing such effect was to remove the low-imped-

ance path of such currents. Accordingly, it was suggested that the neutral on the low side of the star-star connected supply bank of transformers be ungrounded. This request was acceded to and the residual current was thereby reduced to a value small enough to have no appreciable inductive effect on the telephone circuits.

With the neutral of the No. 1 circuit supply bank grounded on the low-voltage side, some transient disturbances on the 60,000-volt line feeding the bank were transformed and caused severe trouble on the telephone circuits. The undergrounding of the neutral eliminated this trouble.

Circuits No. 2 and No. 3 are supplied from a star-star connected bank employing a grounded neutral, but all other transformers on the two lines are isolated. The star-connected supply bank has two taps on the low side so that power may be supplied at star voltages of 10,000 and 8,700 volts. From the 10,000-volt tap energy is supplied over a third circuit not involved in the parallel. Hence a shunt path is provided for the third-harmonic residuals, thus reducing the magnitude of such current in the line involved in the parallel. This condition, coupled with the fact that a high-impedance path is offered to residual currents via the earth due to the presence of a ground at but one end of the circuit, sufficiently reduces the magnitude of residual current in this short parallel so that its inductive effect can be tolerated.

CASE II.

Case II presents an example of a parallel with a power circuit employing a grounded neutral at one point only. (See illustration, Case II). It is of interest to state at the outset that this parallel is one which has recently been studied, the remedial measures outlined below installed in part and elaborate tests made to determine their efficacy. The details of the parallel and characteristics of power and telephone systems are as follows:

Power System. 60,000 volts, three-phase, 60 cycles, triangular configuration; 6-foot spacing; delta-delta connected transformer banks throughout the system with one exception; a star-connected bank with grounded neutral at one end of the line (see Case II.) Three existing transpositions; two within parallel and one outside.

Telephone System. One long-distance telephone circuit and several long suburban circuits. Standard system of transpositions.

Parallel. 75,090 feet in length; separation between power and telephone leads, 45 feet. Two crossovers, one of which is at the end of the parallel.

Co-ordinated Transposition Scheme. In this case a long uniform parallel is presented which offers an excellent opportunity for the use of the exposed line *A* section.

The method was adopted of installing first a very small number of transpositions in the power circuit to determine the extent to which the induction was reduced. The design is such that additional power transpositions can be economically installed if later found desirable.

Referring to Fig. 2, Case II, beginning at point *a* (the commencement of parallelism) an exposed line *A* section is installed of such length that it occupies eight-ninths the total distance from point *a* to the crossover at point *b*. Thence, two *X* sections of equal length extend to the crossover point *b*. Transverse balance is obtained when the existing power transposition is removed. Longitudinal balance to induction from the balanced voltages and currents of the power system is accomplished by installing a barrel in the power circuit between points *a, b*, with two transpositions opposite the three-ninths and six-ninths points of the telephone transposition system.

From the crossover at point *b*, another exposed line *A* section is installed of such length that it occupies eight-ninths the total distance from point *b* to the end of the parallel at point *c*. Thence two *X* sections of equal lengths are installed, extending to the end of the parallel, at *c*.

Transverse balance is obtained when the existing power transposition in this section is removed. Longitudinal balance is obtained in the same manner as outlined for section *a, b*, but with reversed rotation of power transpositions, the purpose of which will be explained below.

Thus, co-ordination of the power and telephone systems is obtained within the parallel in so far as induction from balanced voltages and currents of the power system are concerned, and also transverse induction balance from the residual voltages and currents.

It will be noted by referring to Figs. 1 and 2 that a junction occurs in the telephone line at a point *d* which would ordinarily be treated as a point of discontinuity, and, therefore, balance to induction should be obtained on either side of it. In this case, such balance is unnecessary since the junction point shown represents a tap off the long distance circuit under consideration. Had one or more circuits branched from the lead or terminated at this point, the other running through, it would have been necessary to make the junction a neutral point and obtain balance independently on each side. This would probably have required the use of short sections in the telephone line and two additional transpositions in the power line.

Mitigation of Residuals.—Due to the presence of the grounded-neutral bank at one station and the triangular configuration used in most of the system the effect of capacitance unbalance of the lines in causing residual voltage will be very small. Hence under the operating condition shown in Fig. 3 transpositions outside the parallel were not in this case necessary. The manner of locating such power transpositions for capacitance balance is however shown in Fig. 3. When the grounded-neutral bank is disconnected from the system there is a considerable residual voltage due to the vertical configuration of the two lines *a b*. The line *a e* being triangular has a much lower capacitance unbalance. Moreover the ultimate replacement of the grounded-neutral bank by a delta-delta bank is contemplated. An attendant advantage of transposing this line throughout its length is the improvement of the power-system telephone circuit which is located on the power-circuit poles.

In view of these considerations it was deemed desirable to rely upon the efficacy of the co-ordinated transposition system and balance of telephone circuits to avoid interference from the triple-harmonic residuals due to the grounded-star transformer bank.

The plan devised for obtaining an approximate capacitance balance is outlined below. If the transpositions according to this scheme prove to be insufficient others can economically be added.

Considering first the two power circuits *a b* (see Fig. 3 Case II) operating in parallel, two 15-mile barrels are installed in each line.

The section involving the parallel *c,d*, is already bal-

anced by virtue of the two barrels installed to co-ordinate with the telephone transposition system and provide longitudinal induction balance within the parallel. Hence one section, *a,c,* and a second section on the other side of the parallel, *d,e,* remain unbalanced. In the section *a,c,* there is an existing transposition, to be retained if possible. Therefore, two barrels of unequal length were installed in the section *a,c,* utilizing in one of them the existing transposition; by reversal of the two transpositions within the section of parallel *b,c,* Fig. 2, the proper type of exposure occurs in the section *d,e,* Fig. 3, which, considered with the section from the existing transposition to point *c* makes up the deficiency in length of the barrel. Hence capacitance balance is obtained by the use of two 19-mile barrels, although using a detached section of power line for balance. This case again illustrates the use of the reversed rotation of power-circuit transpositions.

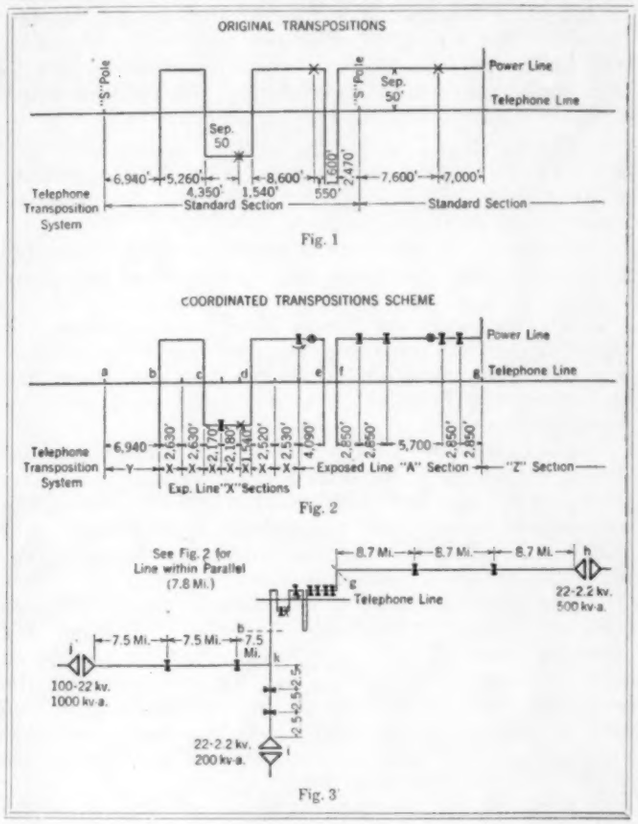


Fig. 1

Fig. 2

Fig. 3

Case III.

It may be stated in connection with this case that the transpositions for capacitance balance and reduction of residual voltage in the power system have not, as yet, been installed. The reason that they were not installed, is that under the present conditions of operation the co-ordinated transposition system within the parallel was determined by test to be sufficient to provide the requisite relief and that the longitudinal effect of the present existing residual currents and voltages was sufficiently small not to warrant greater refinement at this time.

CASE III

In Case III (see illustration Case III) is given a typical example of parallelism between a telephone line and a power line operated isolated from ground. The details of this case are as follows:

Power System. 22,000 volts, three-phases, 60 cycles. All three conductors in same horizontal plane, spacings 35 and 65 inches. Delta-delta transformer connections at three stations. Three existing transpositions within the parallel.

Telephone System. Long-distance telephone circuits; 10 physicals and four phantoms. Standard systems of transposition.

Parallel. 38970 feet in length; separation between power and telephone pole leads, 50 feet. Five crossovers.

Co-ordinated Transposition Scheme. Owing to the number of points of discontinuity in this case (crossovers) short telephone transposition sections (*X* sections) in combination with an *A* section, all of the exposed-line type, together with power-circuit transpositions as shown in Fig. 2 of Case III, give the best arrangement.

From the first neutral point of the telephone transposition system *a* (end of an existing section) adjacent to the beginning of the parallel, a *Y* section is installed, terminating at the first crossover *b* (beginning of the parallel). Thence, two exposed line *X* sections of equal length to the second crossover *c*, thus obtaining transverse induction balance of all telephone circuits in the section of parallel *b,c,* from both the balanced and residual currents and voltages of the power system. From the second crossover *c* to the third crossover *d*, three *X* sections are installed two of which are of equal length inserted between the crossover and the existing transposition in the power circuit. A transposition is installed in the power circuit opposite the junction point of the first two *X* sections. Transverse balance and approximate longitudinal balance to induction are accomplished by this arrangement in section *c,d.* If the existing transposition in the power circuit had been at one of the third-points of *c,d,* exact longitudinal balance would have been obtained. It will be seen that here a sacrifice in longitudinal balance was made in order to retain an existing power transposition.

From the third crossover *d* to point *g*, the end of the parallel, two *X* sections and one *A* section are installed. The exposed line *A* section is of such length that the pole of two-eighths of its length falls at the crossover point *f*. The two *X* sections are installed between the point *d* and the first pole in the *A* section and are of equal length. A power circuit transposition of reversed rotation is installed opposite the junction of the *A* and *X* sections, thus giving in combination with the section *b,c,* approximate longitudinal balance in the total section *b,c,* and *d,e*. The existing power transposition in section *d e,* is removed. Whole-line transpositions are installed in the *A* section between the one-eighth and two-eighth points in order to reduce the transverse unbalance incurred due to the interruption in parallel from *e,f*. Thus, transverse balance has been obtained in the section of parallel *d,e*.

In section *f,g,* power transpositions are installed opposite the three-eighth, four-eighth, six-eighth and seven-eighth points of the *A* section, thus accomplishing longitudinal and transverse balance to induction in this section. The existing power transposition in the section *f,g,* is removed.

It will be seen that a co-ordinated system of power and telephone transposition has been applied which balances to both transverse and longitudinal induction from the balanced voltages and currents of the power system, and transverse induction from the residuals of the power system.

Mitigation of Residuals. Since in this case an isolated system is involved and the flat configuration causes a large residual voltage, the remedial measure required is transposition of the power circuit outside the parallel in such a manner as to balance the capacitance to ground of the several phases.

In order to determine how small a number of transpositions would give relief in this case, it is proposed to install very long barrels in the sections of power line beyond the exposure, as indicated in Fig. 3. These will not be entirely effective if high-frequency components in the power circuit are prominent. The method of laying out these transpositions is as follows:

The transpositions of the power circuit within the parallel for longitudinal induction balance from the balanced voltages and currents also provide capacitance balance for this section of power line. It remains to transpose the section of line outside the parallel so that capacitance balance is obtained throughout.

In the section between one limit of the parallel *g* and the sub-station *h* (26 miles), one barrel is cut in the power line by installing two transpositions of normal rotation at the one-third and two-third points.

In the section between the other limit of the parallel *b* and substation *j* (22.5 miles), a barrel is cut in the power line by installing two transpositions of normal rotation at the one-third and two-third points.

The section from the power line junction point *k* to substation *i* (7.5 miles) is cared for in a like manner.

Thus, in each of the four sections cited, capacitance balance is obtained. Attention is called to the manner in which the practical consideration such as length of line and location of discontinuities arbitrarily determine the length (maximum) of power circuit barrel both from the standpoint of co-ordination of transpositions and measures for capacitance balance.

This case is one which was presented for solution in the field. However, for the purpose of simplifying the discussion, the extent of power system beyond either end of the parallel has been greatly reduced.

The above cases, it is thought, will serve to give a general idea of the practical methods pursued in the field for the solution of inductive interference problems. It must be remembered that the remedial measures set forth in the above cases are not necessarily applicable to other casess, and that each case requires a consideration of its particular conditions in order that adequate remedial measures may be provided.

In conclusion, we can say with conviction, based upon the facts cited in this paper and our actual experience, that the general problem of inductive interference involving three-phase circuits, while seemingly difficult of solution, is in fact, when fairly and reasonably approached, usually simple and inexpensive. The remedial measures employed, when properly designed and installed, are very effective. It is true that occasionally a problem will arise, the solution for which will impose some burden on one or both interests involved. When such a problem does arise, it is capable of solution only through a broad co-operative spirit between the two parties and their mutual willingness to bear such burden for the welfare of the community.

APPENDIX I—DATA REQUIRED IN CASES OF PARALLELISM

To Facilitate the Determination of Remedial Measures for the Mitigation of Inductive Interference

The severity of the inductive interference with telephone service caused by any given parallel is dependent upon the physical characteristics of the parallel, the electrical characteristics and method of operation of the power system, and the condition of the telephone circuits. The following pages describe the data necessary for a study of a parallel to devise means for the prevention or reduction of inductive interference arising therefrom. In order that the best results may be secured, the instructions given herein concerning the preparation of the report transmitting the required data should be very carefully followed.

In the case of a proposed parallel, or general reconstruction of an existing parallel, a study shall be made to determine whether or not other routes are available, for either the telephone or power lines involved, which will avoid the parallel. A report on possible alternatives shall be presented in connection with the transmittal of other data concerning the parallel.

The forms and instruction of this circular have been devised to facilitate a complete report on parallels already in existence; the same general plan can be followed, however, for proposed parallels.

If any of the data are doubtful the best obtainable information shall be given and its degree of reliability stated.

A—Telephone and Power Line Data. A form for reporting the data regarding the power and telephone line is given. The form should be typed or mimeographed as convenience dictates. It is self-explanatory as to information required.

B—Exposure Chart. The telephone pole line involved in a parallel shall be plotted as a *straight line,* from left to right in the direction of transposition. The scale should be 4,000 feet per inch, or 2,000 feet per inch for short parallels and any case where complications render a smaller scale undesirable.

The power line *and all arc circuits, distribution circuits of 2,200 volts or over, telephone, telegraph and signaling lines of other companies,* shall be plotted so as to indicate continuously along the telephone line the horizontal separation between the telephone pole line and the pole or tower lines supporting such other circuits. *These are to be plotted only within the exposure to the high-voltage power line.*

The scale for plotting separation will depend on the average separation; 50 feet per inch is usually convenient. The accompanying exposure chart, shows an example of a parallel and how the chart is to be plotted.

Distances measured along the telephone line from a given reference point, (and corresponding telephone pole numbers) shall be shown for:

a. each telephone transposition pole, with transposition lettering

b. loading points

c. beginnings and ends of parallels

d. points where power lines cross over telephone lines

e. points where abrupt changes in separation occur

f. points where changes in configuration of power or telephone circuits occur

g. location of bridged stations and sections of cable in the telephone line

h. power-circuit transpositions

i. points where load or feeded branches connect with power line

j. places where there are spans of excessive length; river crossings, railroad crossings, etc.

k. each tower in case power circuit is supported on towers.

The chart shall contain as many sketches of the cross-section of the exposure as are needed to show the several types of construction, configuration and relative location of lines. A note under these shall specify the point at which each type begins and ends. These diagrams should show:

a. average pole or tower heights

b. difference in elevation of ground under the two lines

c. dimensions to locate points of support and spacing of all wires on poles or towers

d. traffic numbers of telephone circuits with the number of the pole to which they apply

A sketch shall be given showing the method employed in transposing the power line and number of poles involved in a transposition.

If special construction is employed at power line crossings, the details shall be given in the report.

Any special construction in the telephone line, such as at river crossing, shall be described in the report.

The chart shall contain a title including the number of the parallel, location, companies involved, voltage of power lines, and date.

The survey of the telephone line shall determine the location of telephone transposition poles, crossovers, power-circuit transposition poles, and other features to at least the nearest 10 feet. This distance should be the "wire distance," where obtainable from the records.

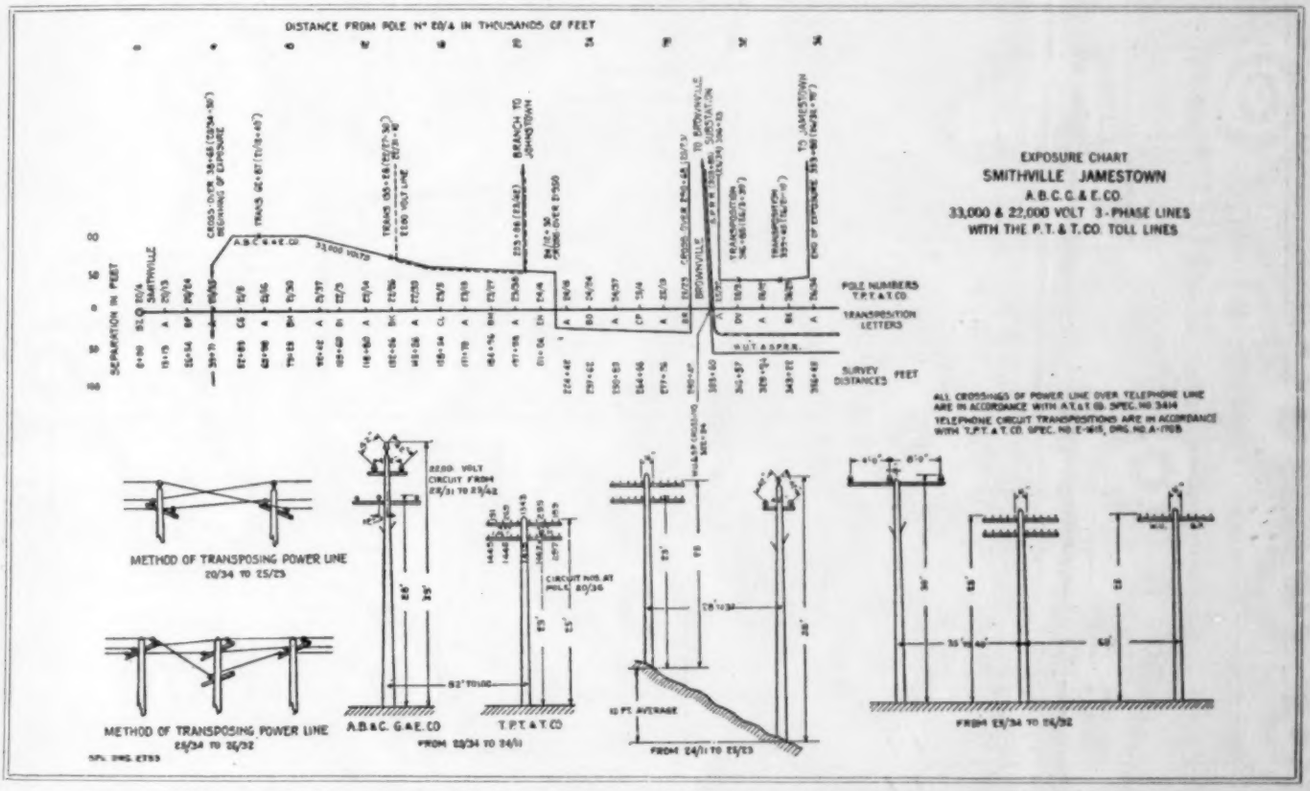
Horizontal separation of pole line shall be measured within 2½ per cent (thus, where the separation is 20 feet, it shall be obtained to the nearest foot, if 100 feet, to the nearest five feet). The heights of wires above the ground shall be given to the nearest foot. The horizontal and vertical distances between wires of a power circuit and wire spacing on the telephone line shall be given to the nearest inch.

Many minor irregularities must be neglected, but the purpose should be to present the average conditions as faithfully as practicable, and to give data of all pronounced changes in the character of construction.

C—Circuit Diagram of Power System. Much of the required information concerning the power circuit can be shown diagramatically as indicated in accompanying illustration. This diagram shall show:

a. All lines or apparatus *metallically* connected to the power circuits involved. Auto-transformers constitute metallic connections between lines of different voltages, hence the circuit diagram should not terminate in such transformers. Lines or apparatus which are connected to the circuit involved in the parallel by two-coil transformers are not required to be shown.

b. Method of connection of both primary and secondary sides of all transformer banks connected to the circuits. Indicate particularly the condition of all neutrals, whether grounded or not. Where single-phase, open delta or Scott connections occur, the particular phase, to which each wire is connected shall be shown.


DISTANCE FROM POLE N° 20/4 IN THOUSANDS OF FEET
EXPOSURE CHART
SMITHVILLE JAMESTOWN
A.B.C.G.& E.CO.
33,000 & 22,000 VOLT 3-PHASE LINES
WITH THE P.T.& T.CO. TOLL LINES
SEPARATION IN FEET
POLE NUMBERS T.P.T.& T.CO
TRANSPOSITION LETTERS
SURVEY DISTANCES FEET
BUTLER PIKE
ALL CROSSINGS OF POWER LINE OVER TELEPHONE LINE ARE IN ACCORDANCE WITH A.T.& T. CO. SPEC. NO 3414
TELEPHONE CIRCUIT TRANSPOSITIONS ARE IN ACCORDANCE WITH T.P.T.& T. CO. SPEC. NO E-465, DWG NO. A-1108
METHOD OF TRANSPOSING POWER LINE 20/34 TO 25/25
METHOD OF TRANSPOSING POWER LINE 25/34 TO 35/32
A.B.& C. G.& E. CO
T.P.T.& T. CO
FROM 22/34 TO 24/11
FROM 24/11 TO 25/25
FROM 25/34 TO 26/32

c. Type and location of air and oil switches.

d. Type, location and connections of lightning arresters.

e. Location and ratio of potential and current transformers; location and range of ammeters in neutral ground connections.

f. Transpositions in the power circuits.

g. The length of power circuit between all points of importance, such as stations, branch points, transposition points, and points where configuration changes, to the nearst 0.1 mile.

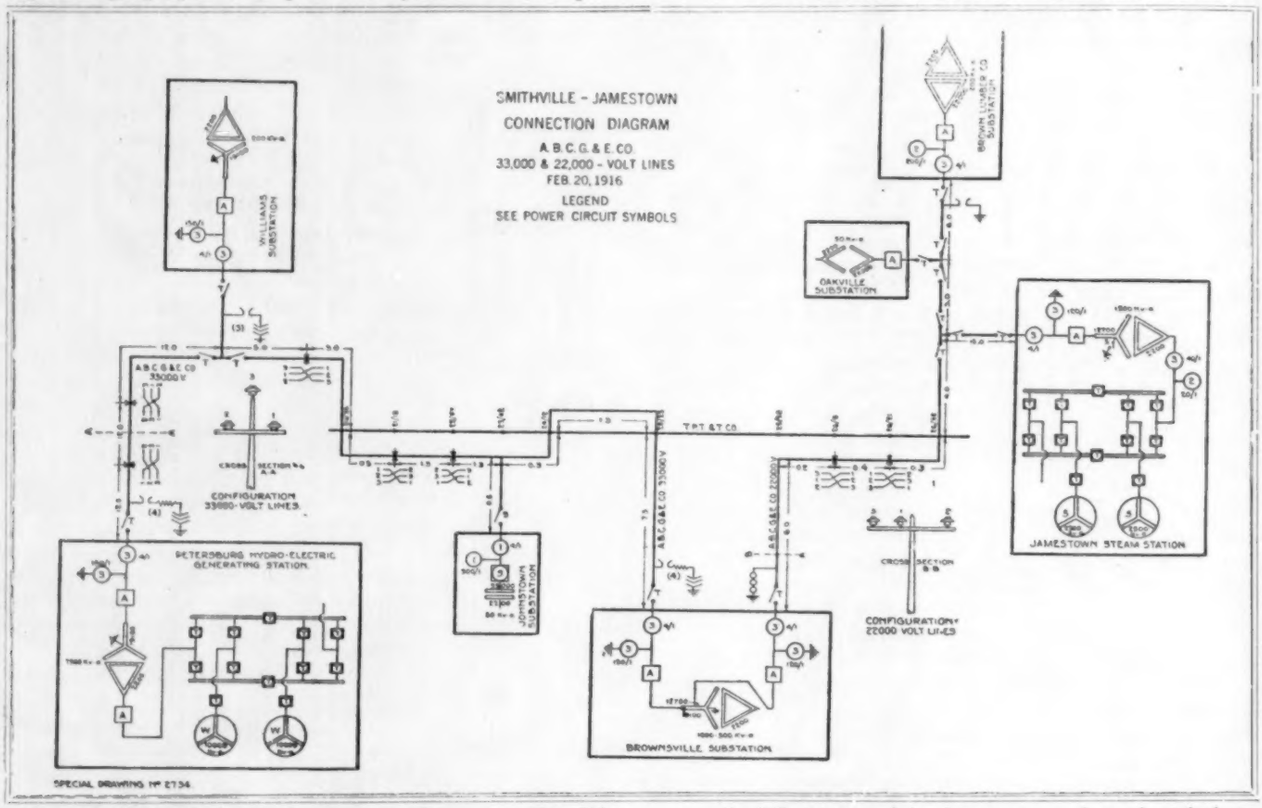
h. Voltages and capacities of transformers or other apparatus connected to the circuit.

i. A cross-section of the power circuit at some one point with the conductors numbered to show their respective positions. If there are two or more circuits, the wires composing each shall be designated.

The title should include name of power company, number of the parallel, location, voltage of power circuits, date and legend.

A list of symbols for use in making up power-circuit connection diagrams, in the manner shown in the illustration is given herewith.

D. General Route-Map. The power and telephone lines shall be plotted on a map whose scale may be several miles per inch. Where available, the U. S. Geological Survey topographical maps are very convenient for this purpose. The toll route-maps of the telephone company can sometimes be advantageously used as a basis. The telephone line shall be indicated as far as the adjacent *S* poles outside of the parallel. The power circuit and substations shall be shown to an extent corresponding to the diagram of connections. In case the extent of the power system makes this impractical, a separate geographical map of the system shall, if possible, be obtained from the power company. Possible routes for either line to avoid the parallel shall also be indicated on this map.



DATA CONCERNING TELEPHONE AND POWER LINES INVOLVED IN A PARALLEL

.....Division Parallel No....
.....191....

I. *General*

1. Location of parallel.....
(Between what towns?) (State)
2. Length, along telephone line.....miles.
(distance between limits)
3. Name of power company.....
4. Number of power circuits.....
5. Is the parallel existent or proposed?.....
6. Which is the senior company?.....

II. *Telephone Line*

1. If parallel is existent, state in detail the nature of the observed trouble.....
.....
2. What other parallels are there involving these telephone lines?.....
3. Is there trouble from secondary induction?.....
4. State the present physical condition of the telephone line. How soon will it require general reconstruction? .....
5. Insulation of telephone circuits
Relative noise on telephone circuits

Circuit No.	Insulation-Megohms per mile Tip	Ring	Mutual	Relative* Noise %
.....	.....	.....	.....	.....

*Estimate noise in per cent of noise on noistest circuit rated at 100 per cent.

6. What is the ultimate capacity of the telephone line?
7. State specification and drawing numbers of telephone transposition system.....
.....
8. If any circuits are loaded, state the location of loading points, give pole numbers within the parallel and at the adjacent loading points outside of the exposure, and state whether or not loading point is an H fixture.....
.....
9. What types of insulators are used on the telephone line? .....
.....
What types of insulators are used at loading points?
.....
10. If the apparatus connected to any circuit is not standard T. P. T. & T. Co. equipment, describe it
.....
11. State location of any points within the parallel at which circuits enter cable (*e.g.*, river-crossings). Give specification number of cable.....
.....
12. Do any circuits branch from the telephone line within the exposure? If so, state traffic numbers and points of branching. If local circuits are also involved in the parallel, give their points of branching .....
.....
13. Telephone Circuits involved in the Parallel

Traffic No.	Physical or phantom	Size and material of wire	Loaded or non-loaded	Terminals
.....	.....	.....	.....	.....

14. Describe special construction in telephone line at river crossings, etc.....
.....
15. State any other pertinent information.....
.....

III. *Power Circuit* No.....*)

1. Voltage .....
(actual operating voltage between wires)
2. Number of phases....., Frequency.....cycles per sec.
3. Power circuit supplied from.....Station...
4. Power circuit supplies energy to.....
.....
5. Character of load, motor, lighting or both.....
.....
6. Average current per phase.....amperes.
7. Average daily maximum current.....amperes.

*If there are two or more power circuits they should be reported separately and every sheet marked to indicate (by number) the particular circuit reported thereon.

17. Switches

Location	Type	Mechanically interconnected for simultaneous action?	What devices are there for automatic operation of switches?
.....	.....	.....	.....

18. Transformers

Location	No. of units	Mfr.	Kv-a. rating	Voltage rating	Form No. etc.	Single or three-phase	If three-phase, shell or core type

19. Rotating apparatus. If generators, motors or converters, etc., are metallically connected to a circuit involved in a parallel or if such circuit connects directly to a generating station, give data as to

Kind of Apparatus	Location	No. of units	Mfr.	Type	Kv-a. rating	Voltage rating	Electrical connection
.....	.....	.....	.....	.....	.....	.....	.....

20. State other pertinent information.....

SYMBOLS—POWER CIRCUITS—E. C. 134.

Transformers. Unless otherwise stated on the connection diagram single phase units are assumed.

Horn gap lightning arrester.

Aluminum cell lightning arrester state in parentheses the number of units.

Same as above except with charging resistances.

Multigap lightning arrester. dependently operated. T-three pole interconnected.

Air Switch S-single poles in-

(S) or (T)

Same as above with the addition of fuses.

(S) or (T)

Oil switch-automatic all poles mechanically interconnected.

A

Oil switch-non-automatic all poles mechanically interconnected. Use "S" in place of "T" if poles are not interconnected.

T

(RATIO)

Current transformers place figure inside circle indicating number of units.

(RATIO)

Potential transformers connected between phases. Place figure inside circle indicating number of units.

(RATIO)

Same as above—connected between phases and ground.

S or W 7,500 kv-a

Generator—three phase delta connected 7500 kv-a S-steam driven W-water wheel driven.

S or W 10,000 kv-a

Generator—three phase star connected, neutral grounded (if neutral is isolated omit indication of ground) 10,000 kv-a. (S and W same as above.)

Miscellaneous apparatus write description in rectangle or reference to descriptive note.

22000 50 kv-a 2200

Transformer — single phase connection 22,000/2200 volts 50 kv-a.

Power circuit transposition.

22000 2200 1,500 kv-a

Delta-delta connection 22,000/2200 volts, 1500 kv-a per unit.

22000 2200 200 kv-a.

Open-delta connection 22,000 2200 volts, 200 kv-a per unit.

12700 2200 1,500 kv-a.

Star-delta connection neutral grounded, ammeter in neutral 12,700/2200 volts, 150 kv-a per unit.

12700 1270 1,500 kv-a

Star-star connection neutral isolated 12,700/1270 volts, 1500 kv-a per unit.

55000 32000 1000 kv-a.

Star-connected auto-transformers neutral isolated, 55,000/32,000 volts, 1000 k-va per unit.

55000 32000 2200 1000 500 kv-a

Star-connected auto transformers neutral grounded, 55,000/32,000 volts, 1000 kv-a per unit. Tertiary delta 2200 volts, 500 kv-a per unit.

2200 11000 150 kv-a.

Scott-connection 2 to 3 phase 2200/11,000 volts, 150 kv-a per unit.

Note—Other transformers connections should be indicated in an analogous manner.

8. Hour at which peak load occurs.....
9. If the neutral points are grounded, are there ammeters in the neutral connections?.....
10. State their range.....
11. Are they connected directly or through current transformers? .....
12. Give ratio of transformation.....
What is the average neutral current?.....amperes.
13. Size of conductors.....ga.
Material of conductors.....
14. In case the power line is existent state its present physical condition. How soon will it require general reconstruction?.....
15. Type of insulators.....
Are the insulator pins grounded.....
If suspension insulators, state number of discs....
16. Lightning arresters.

Location	Type	Connections	Frequency and time of day of charging	Charging current-amperes per phase
.....	.....	.....	.....	.....

What is the method of charging?.....
.....

War Tax Is Removed

Notices posted at pay stations of telephone companies all over the country announcing the war tax of 1 cent on telephone messages for which there is a charge of 15 cents or more, are being removed. The collection tax in connection with telephone calls made from both public telephones and from subscribers' stations was discontinued at midnight, September 8, when the new revenue law abolishing the tax went into effect.

The penny telephone tax imposed by the emergency revenue law, which was approved on October 22, 1914, and which became effective on December 1, 1914. Under the provisions of this law, the telephone company was required to collect the tax from persons paying for the messages, and turn the money over to the collector of internal revenue.

A man is known by the job he holds.

MINNESOTA TELEPHONE NEWS

BY THE MINNESOTA INDEPENDENT TELEPHONE ASSOCIATION
824 McKnight Bldg., Minneapolis, Minn.

THE complaint of James Keenan against the Northwestern Telephone Exchange Company came on for hearing before the Minnesota Commission on the 15th day of December, 1915, at its office in St. Paul, Minn., complainant appearing by A. W. Wright, attorney; respondent by A. E. Prendergast, attorney. The complaint was brought by James Keenan, a resident of the city of Austin, Mower county, Minnesota, and president of the Interstate Telephone and Telegraph Company, a subsidiary of the Tri-State Telephone and Telegraph Company. The gist of the complaint is that the Northwestern Telephone Exchange Company is giving free telephone service to subscribers, and is also charging rates below the cost of the service, and that said rates are discriminatory and are intended to and naturally tend to destroy competition between telephone companies within the city of Austin. Complainant requested the commission to order the company to charge adequate rates, forbid free service, and to cease its discriminatory and unlawful practices.

The Northwestern Company purchased a local plant in Austin in 1898 and has ever since maintained a local exchange at that point, which through its toll lines connects with a large number of other exchanges owned or connecting with the lines of said company. In the year 1903 the Dexter and Mower County Farmers Telephone Company unsuccessfully sought a connection with the Northwestern Company's plant at Austin. Business men of the city were anxious to secure connection with this line so they could talk to farmers in the villages of Dexter, Sargent, Brownsdale, Elkton, Rose Creek, Grand Meadow, Pleasant Grove, Spring Valley, Welcome, and numerous townships, embracing about two hundred telephones, and thus enable them to compete with the city of Rochester for the business of those communities. A committee of the leading business men was appointed to confer with the Northwestern Company about this conection, but their mission failed. During this time there was also complaint about the toll service, it being necessary for some subscribers to go to the central station to talk. As a result of these complaints the Interstate Telephone and Telegraph Company was organized in 1903 by local parties and the new company immediately connected with the rural line referred to, and has maintained the service ever since. At the time this company was organized the Northwestern Company had 325 subscribers in Austin. A year later it had but 125. By that time it had lost practically all of the business subscribers upon the main street of the city. It reduced its rates, installed a new and complete central energy exchange and replaced the Blake type transmitter telephones then in use in residences with a type of telephone having solid back transmitters. Although the improvements in the exchange and service were substantial, yet in the year 1911 they had only secured eleven additional single party business telephones, had lost twenty-five two-party business telephones, two one-party residence telephones and had made a gain of 228 two-party residence telephones. In that year the company further reduced its rates to the present schedule, which is as follows:

Individual line business	$2.50
Two-party line business	2.00
No discount allowed on business telephones.	
Individual line residence	$1.00 gross
Two-party line residence	.75 "

Subscribers to individual line busines telephones are entitled to residence telephone service without additional charge. It also offered to give desk telephones at the same price to all subscribers.

The residence rates are subject to discount of twenty-five cents if paid on or before the fifteenth of each month. Since the introduction of these rates and service there has been a very pronounced increase in the number of telephones used, e. g.:

One party business	75
Two " "	10
One " residence	62
Two " "	582

so that in 1915 the total number of telephones used was 1317 as against 590 in 1911.

The company testified that in the year 1914 the total exchange and toll revenue amounted to $13,640.03, while the total operating expenses, *excluding depreciation*, amounted to $14,437.53, a net loss of $797.50. If allowance had been made for depreciation the loss would have been much greater. The Northwestern Company admits that the rates charged in Austin are not compensatory and the commission so finds.

The Northwestern Company insists that it was compelled by the competition of the locally organized company to make the changes in rates and service in order to protect its own property; that it has a right to met competition by charging rates which do not pay operating expenses, and that the combination business and residence service follows an established practice for the purpose of developing business and is therefore not a violation of the free service law.

The rates charged by the Interstate Company in 1903 have not been changed, and are as follows:

1 party business	$2.00
2 " "	1.50
1 " residence	1.25
4 " "	1.00
Rural telephones	1.25

No discount is allowed on these rates.

In the year 1915 it operated 1662 stations, of which 579 were rural, 57 private line residence, 726 two-party residence, 243 business, 45 extensions and 12 employes' telephones. It has lost 34 two-party residence telephones since 1914.

The statement filed shows the claimed value of the property to be $115,048.09; that its gross earnings from operation for the year 1914 were $22,997.67; total operating expenses, including interest on taxes and depreciation amounted to $20,071.61, leaving a net return of 5.2 per cent upon the claimed value of the property.

This company claims that the free residence telephone given to the subscriber of the business telephone by the Northwestern, and the low rates for residence telephones, are made for the purpose of driving out competition and creating a monopoly within the city

of Austin, and that the rates so made are illegal, unequal, inadequate and discriminatory.

There are but two issues in this case:

(1) Whether the Northwestern Company may continue to give free residence telephone service to subscribers of a business telephone.

(2) Whether it may continue to furnish service within the city of Austin at rates less than those charged by its competitor, where such rates are so low as to be non-compensatory.

The first question is disposed of by Section 11, Chapter 152, which provides that:

> Telephone companies may furnish service free or at reduced rates to its officers, agents, or employes in furtherance of their employment, but it shall charge full schedule rates without discrimination for all other service.

Under the law telephone companies must file schedules of rates for the different classes of service which they render. Companies which offer business and residence rates should publish a separate and distinct rate for business telephones and residence telephones, and a so-called combination rate for a business and a residence telephone, which is less than the sum of the regularly published residence and business rates is unlawful. This practice results in giving free residence service, and is also a discrimination against the subscriber of a business telephone who does not use a residence telephone. This practice is forbidden by the statute.

This conclusion is generally supported by the decisions of other regulatory bodies of the country.

The second question raised in this case is controlled by that part of Section 18 reading as follows:

> The requirements as to reasonableness of rates shall apply to each exchange unit as well as to telephone plants as a whole. No telephone rates or charges shall be allowed or approved by the commission under any circumstances which are inadequate and which are intended to or naturally tend to destroy competition or produce a monopoly in telephone service in the locality affected.

The record shows that the rates charged by the Northwestern Company in Austin do not secure enough revenue to meet the expenses of operation. Under these circumstances no depreciation from local earnings can be set aside to preserve the property, and no return can be made upon the investment. Funds secured from the operation of the system as a whole must be used for making up the deficit, provide for necessary replacements, and preserve the integrity of the plant. This will not embarrass the company because its system extends through several states; it is a member of the Bell group of telephone companies, radiating throughout the United States, and it is apparent that it is in a position to operate the plant at Austin at a large loss each year for an indefinite period without affecting the net surplus of the company or the Bell system. It can charge a fifty cent or a much lower residence rate if it becomes necessary to do so to meet competitive conditions in Austin.

The Interstate Company cannot afford to charge the same low rates. Eventually it must meet them or go out of business, and this will give the successful competitor a monopoly of the business in that locality, and when that condition obtains it will be in a position to charge a rate which will produce a reasonable return for the service rendered; in fact, the Northwestern Company admits that it opposed competition in the telephone business, that rate wars result from competition, and that ultimately one company must have the field to itself in Austin.

The records of the office show that substantially similar rate wars are taking place in several cities and villages in the state.

The Telephone Bill was prepared by the telephone companies, was approved and supported by them in the last legislature, and it must be assumed that it was framed to meet the conditions that existed in this state. What, then, did the legislature mean when it instructed the commission not to allow or approve of rates under any circumstances which are inadequate and which are intended to or naturally tend to destroy competition or produce a monopoly in telephone service in the locality affected? A careful reading of the law sheds light upon the meaning of this clause. The commission is given regulatory power over the rates and service; rates shall be just and reasonable, must be filed with the commission, and cannot be changed without its consent, and the commission is authorized to prescribe reasonable new rates to replace the old. The published rate must be charged—no discrimination shall be practiced or free service given except in enumerated cases. The commission must prescribe uniform rules and classification and a system of accounting to be used by the companies; may inspect their books, files and records; order physical connections under certain circumstances; issue indeterminate permits in lieu of existing franches; permit the location of a telephone plant in a city or village when there is an exchange in operation; fix the annual depreciation charge for each company which shall be sufficient to provide the amounts required over and above the expense of current maintenance to keep its property in a state of efficiency corresponding to the needs and progress of the industry; and finally, to determine the value of telephone properties for rate making purposes.

Manifestly the legislature intended to give the commission power to compel telephone companies to give good service and to authorize rates which will yield enough money to insure such service; to protect properties from merciless rate warfare, and to make investments in such properties more secure and inviting. It recognized the existence of competition by forbidding rates which tend to destroy competition or produce a monopoly. Adequate rates are those which are necessary to provide revenue with which to pay reasonable operating expenses of a utility prudently constructed and managed, provide for depreciation, and to pay a return upon the investment in the property used and useful in the public service, without imposing an unjust burden upon the public. An inadequate rate is one which fails to accomplish these purposes. The record in this case shows that the rates as a whole of the Northwestern Company in Austin are not adequate. The company admits that they are non-compensatory. Are the rates intended to or naturally tend to destroy competition or produce a monopoly in that locality?

The history of the struggle between these two companies, shown by the record in this case, and of which the commission has also judicial knowledge, proves that the practice of giving free residence service to the subscriber of a business telephone, and of reducing the residence rate to fifty cents per month, was introduced for the purpose of forcing its competitor out of business in that locality, and thus giving to the Northwestern Company a monopoly of the business. No other con-

clusion can be reached. The commission finds that the rates charged by the Northwestern Company at Austin are inadequate and are intended to and naturally tend to destroy competition and to produce a monopoly in the telephone service in the locality affected.

Questions affecting the same principle have been presented to other regulatory bodies. Generally speaking the commissions have denounced the rate wars and have, when permitted by law, compelled the competing companies to publish equal and reasonable rates, thus permitting competition to be confined to service conditions instead of non-compensatory rates.

In the case of Residents of Coxsackie vs. Upper Hudson Electric Company, the New York Public Service Commission, Second District, decided May 9, 1912, Leaflet 6, page 59:

> Competition cannot justify one of the competitors in fixing an exceedingly low price for its service in the competitive locality and recouping itself from earnings in non-competitive territory; and in general, under the regulation imposed by the state competition may not be made the excuse for abuse.

In the Milwaukee Lighting Cases the Wisconsin Commission, Volume 9, page 550, discussed the question as follows:

> That practices of this kind under such competitive conditions as those which prevail in Milwaukee should lead not only to unjust and serious discriminations but to disastrous rate wars from which in the end only harm can come to the public, is obvious to all who have paid attention to such matters. Unjust personal discriminations are always injurious, not only to the person adversely affected, but from the view of public interest. When carried far enough, or in their exaggerated form, they usually drive those who are not favored out of business and leave the favored persons in control of the situation. In the past such practices have often defeated the laws of competition. It has also, as a rule, led to questionable business practices in other respects.
>
> Rate wars usually mean, for a time at least, lower than paying rates, failure to keep the plant in good operating condition, and in the long run inadequate service. They often result in financial ruin to one or more of the plants involved, the crippling of the rest, and in the ultimate consolidating of the remnants of all into one concern. When peace has in this way been restored, it is often necessary, in order to secure adequate service, to advance the rates, not only to the level which prevailed before the contest, but to even higher figures. This has been the history of rate wars from their beginning, and there is nothing to indicate that this would not be the result in these cases. If the war was permitted to go on, such results could not even be entirely prevented by the Public Utilities Law, for the only way in which ruined plants can be made to furnish adequate service is through the investment of additional capital, and this can only be had at rates that are high enough for reasonable returns. In one way or another losses and destruction due to rate wars are in the end almost certain to have to be borne by the public. In the end the customers will also lose more through bad service and high rates than they gained through the temporary low rates which they enjoyed during the struggle. In the public utility field rate wars are so clearly against public policy that they should not be permitted under any circumstances. This also is recognized in the Public Utilities Law, for it is clearly in order to enable this Commission to prevent or stop such struggles that Sec. 1797-99 was included therein.

It is therefore ordered that the Northwestern Telephone Exchange Company be required to cease and desist from giving free residence service to subscribers of a business telephone; also that it publish and collect net residence rates no lower than $1.00 per month, this order to take effect the first day of September, A. D., 1916, and remain in effect until the further order of the commission.

Note.—The Northwestern Company has petitioned the commission for a re-hearing in the above case, upon that part of the order which requires the company to collect a net residence rate not lower than $1.00 per month, and the commission is of the opinion that the same should be granted.

It was, therefore, ordered that the case be re-opened upon that branch at a hearing held before the commission on September 28, at two o'clock p. m., at its office in the State Capitol, St. Paul.

THE RAILROAD (C. ST. P. M. & O. RY.) COMPANY REFUSES TO INSTALL A TELEPHONE IN THE DEPOT AT BREWSTER WITHOUT FIRST MAKING A FIGHT.

In the matter of the petition of L. E. Johnston, T. A. Maher, L. A. Stude, G. W. Wakeman and one hundred and ten others, for telephone service in the depot of the Chicago, St. Paul, Mineapolis & Omaha Railway Company at Brewster, Minnesota, a hearing was ordered to take place before the commission in the rooms of the Commercial Club at Brewster, Nobles county, on Tuesday, the 26th day of September, at 10:30 a. .m. and all parties interested might appear at such time and give evidence for or against the granting of said application. Notice of the hearing was given by serving a copy thereof by mail upon L. E. Johnson, T. A. Maher, L. A. Stude, G. W. Wakeman and the officers of the Chicago, St. Paul, Minneapolis & Omaha Railway Company.

The railroad's answer to the commission's demand, which is no doubt interesting to every telephone company in the state, is as folows:

> Now comes the Chicago, St. Paul, Minneapolis and Omaha Railway Company, the respondent in the above entitled proceeding, and for this its answer to the petition of the complainants alleges:
>
> (1) That it is a railway corporation organized under the laws of Wisconsin, with a line of railway extending among other places, in the states of Wisconsin and Minnesota, including a line of railway extending through the village of Brewster, Nobles county, Minnesota.
>
> (2) Admits that the Fulda Telephone Company operates a telephone exchange at Brewster, Nobles county, Minnesota, alleging that the Fulda Telephone Company is the successor of Brewster Telephone Exchange Company.
>
> (3) That the said railway company has a contract for telephone service which is binding on the Fulda Telephone Company, a copy of which contract is hereto attached and made a part hereof; that said contract is in full force and effect and the reason that the complainants have not telephone service is because of the failure of the Fulda Telephone Company to install a telephone in the depot of the said railway company and furnish telephone service pursuant to the contract in such case made and provided; and the failure of the complainants to receive telephone service is not the fault of the respondent.
>
> (4) That the business of the respondent is transportation, and to supply the public with conveniences not connected therewith is no part of the ordinary duty of the respondent; that supplying the complainants with telephone service and connection is not the business of transportation; that furnishing telephone service is, accordingly, not compellable against the respondent, and the Railroad and Warehouse Commission of Minnesota is without jurisdiction in the premises.
>
> (5) That an order of the Railroad Commission in the premises requiring respondent to install and maintain, at its own expense, a telephone at its depot at Brewster, amounts to a taking of the company's property without due process of law and in violation of the Fourteenth Amendment to the Constitution of the United States, and such an order would be and is arbitrary, unreasonable and unlawful: that such order of the commission in the premises would impair the obligations of the said contract and would be in violation of Section 10 of Article 1 of the Constitution of the United States.
>
> (6) Denies each and every allegation, matter, fact and thing in said petition contained, except as heretofore admitted.
>
> Wherefore, the respondent prays:
>
> (1) That the commission refuse jurisdiction in the premises.
>
> (2) That the commission refuse the relief prayed for.
>
> (3) That in the event the commission makes an order requiring a telephone service at the depot at Brewster, that such service be furnished under and pursuant to said contract.
>
> (4) That in the event that the commission makes an order

requiring telephone service at the depot at Brewster, that such order be binding as well on the Fulda Telephone Company, leaving the Fulda Telephone Company to its proper redress in the courts for the collection of its telephone tolls, if any such telephone tolls be claimed by the said Fulda Telephone Company.

(5) That the commission order in the Fulda Telephone Company as a party to this proceeding, if the commission is so advised, and for general relief.

EXTRACT FROM A LETTER BY THE COMMISSION TO THE ARTICHOKE & CORRELL TELEPHONE COMPANY RELATIVE TO THAT COMPANY CHARGING "10c OTHER LINE" FOR MESSAGES TERMINATING ON THEIR LINES.

NOTE.—This letter is published now in answer to recent inquiries received by the Association with reference to the legality of additional charges (other than the regular terminal fee) for toll messages terminating on rural lines.

It appears from the reports on file in this office and your communication under date of February 12 that your company operates rural lines only, and for which you charge the subscriber on your lines a flat rate of $1.00 per month; that certain of your rural lines are connected with exchanges of the Northwestern Telephone Exchange Company for service, and for which you pay that company 15 cents and 25 cents per telephone per month; that on all incoming long-distance messages over the lines of the Northwestern Telephone Exchange Company, and terminating at subscribers' stations on the rural lines of your company, that they have paid you what was termed an "other line" charge of 10 cents per incoming message, which 10 cents it is also presumed was collected by the Northwestern Telephone Exchange Company from a person originating a long-distance call in addition to the regular toll charge.

For your information, I am directed to advise you that it is generally considered that the local exchange with the rural lines connected therewith, whether owned or merely switched thereby, constitute a single unit for telephonic service, and that no extra fee on incoming or outgoing toll messages should be charged subscribers within these limits.

The flat rate which you charge to the subscribers on your lines, which in your case is $1.00 per month, is presumed to cover all service to and from the subscribers on your rural line, whether that service is for the purpose of inter-communication between the subscribers on any particular line of your company or whether that service is for inter-communication between the subscribers on the lines of your company and those connected with or receiving service through the particular exchange to which your rural lines are connected for exchange service.

The additional 10 cents, or so-called "other line" charge which is applied to each incoming long-distance call, and which it is presumed is collected by the long-distance company in addition to the regular toll charge at the point at which the message originates, might properly be called a delivery charge, and has the effect of making a different rate for long-distance calls, according to the direction of a message; for instance, a person at the originating end of a toll message where the toll charge amounts to 25 cents, if charged an added compensation for the delivery of the toll message over the lines of the local exchange and its connections would be compelled to pay a toll fee of 35 cents, while if the same message originates upon one of the rural lines of your company connected with the exchange through which the long-distance message is switched, the toll fee charged to that person would only be 25 cents as, from the schedule of rates filed by your company there would be no added charge collected from the subscribers of your rural lines when a long-distance message originates with that subscriber.

Section 7 of the Telephone Act provides that:

"No telephone company shall charge, demand, collect or receive from any person, a greater or less compensation for any service rendered by it than it charges, demands, collects or receives from any other person for a like and contemporaneous service under similar circumstances."

The commission is of the opinion that the service given a subscriber of the Artichoke & Correll Telephone Company to some point outside of your system is substantially similar to the service given to a subscriber who talks from that point to a subscriber on your system, and therefore it is a discrimination under the law for you to impose a 10-cent charge on an incoming message, as no charge is made on an outgoing message.

THE STANDARD TELEPHONE COMPANY OPERATING EXCHANGES AT PRESTON AND CALEDONIA, MINN., MAKES APPLICATION TO INCREASE ITS RATES ON DIFFERENT CLASSES OF SERVICE AT BOTH EXCHANGES.

Application has been filed by the Standard Telephone Company, in which it is alleged that it is furnishing reasonably adequate telephone service and facilities for the accommodation of the public and its subscribers and patrons connected with the Preston and Caledonia exchanges and that the rates now in effect for such service are unfair and unreasonable insomuch as said rates are too low and are inadequate to pay operating expenses and afford a reasonable return upon the fair value of the property being used for the furnishing of said telephone service to the public, and it is therefore necessary to increase the local exchange rates as follows:

AT CALEDONIA EXCHANGE.

One party business, from	$1.25 per mo.	to	$2.00 per mo.
One party residence, from	.75 per mo.	to	1.25 per mo.
Two party residence, from	.....	to	1.00 per mo.
Four party residence, from	.75 per mo.	to	.....
Extension telephone, from	.50 per mo.	to	.50 per mo.
Rural station (owned), from	1.00 per mo.	to	1.25 per mo.
Rural station switching (foreign)	1.00 per yr.	to	3.00 per yr.

AT PRESTON EXCHANGE.

One party business, from	$1.50 per mo.	to	$2.00 per mo.
One party residence, from	.90 per mo.	to	1.25 per mo.
Two party residence, from	.....	to	1.00 per mo.
Four party residence, from	.90 per mo.	to	.....
Extension telephone, from	.....	to	.50 per mo.
Rural station (owned), from	.....	to	1.25 per mo.
Rural station switching (foreign)	1.00 per yr.	to	3.00 per yr.

A hearing in the above entitled matter is hereby fixed to take place in the Syndicate Hall at Preston, Fillmore county, on the 4th of October at two o'clock p. m. and in the City Hall at Caledonia, Houston county, on the following day at ten o'clock a. m., and all interested parties may appear at such time and give evidence for or against the granting of such application. Notice of hearings have been given by serving a copy thereof by mail upon the officers of the Standard Telephone Company and by publication in one issue of *The Times*, Preston, and *The Journal*, Caledonia.

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11 TOWNS ARE NOW ENJOYING DEPOT TELEPHONE SERVICE AND THE TELEPHONE COMPANIES ARE BEING PAID FOR THAT SERVICE BY THEIR EFFORTS IN CIRCULATING PETITIONS, THROUGH THE AID OF THE ASSOCIATION.

Some of the petitions sent out by the Association at the request of the local companies or their telephone patrons, have not as yet been filed with the commission, but many of them have, as well as a couple of towns that drew up their own form. The railroads have not answered the demand by the commission in all cases, but with the exception of Brewster the request for service has been granted in each answer to date.

The Brewster situation is different from the other petitions filed, as the railroad has a contract with the telephone company for free service and that case will probably be fought more on the question of validity of contract, although the attorney general's office has already ruled against this particular contract.

Here are the 11 towns which the Association, through the Commission, has so far succeeded in getting the railroad to agree to install a paid telephone in the depot:

Montrose	..population	284	Great	Northern	Railroad
Waverly	.. "	460	"	"	"
Maple Plain	"	230	"	"	"
Hewitt	.... "	322	"	"	"
Cottonwood.	"	1,099	"	"	"

Eagle Bend	"	551	"	"	"
Herman ...	"	604	"	"	"
Bagley	"	801	"	"	"
Hazel Run.	"	122	Minneapolis & St. Louis		
Ivanhoe ...	"	484	Chicago & Northwestern		
Arco	"	197	"	"	

There are many telephone companies in the state that were, and probably are still, giving free depot telephone service, which is contrary to the law and should be stopped, otherwise someone is liable to make complaint to the commission.

The Association will gladly assist any company to get paid for its depot service on the same basis as other business patrons pay, but in order to do so the company must co-operate.

NORTHWESTERN COMPANY APPLIES FOR AN INCREASE OF ITS LOCAL EXCHANGE RATES AT COLD SPRING.

In the matter of the application of the Northwestern Telephone Exchange Company to increase its local exchange rates at Cold Spring, Minnesota.

Application has been filed by the Northwestern Telephone Exchange Company, in which it is alleged that it is not giving service at night and on Sunday or holidays, that the telephone subscribers have requested twenty-four-hour service every day, including Sundays and holidays by presenting a petition to the telephone company, which petition had fifty-seven signers representing fifty-one telephones out of a total of sixty telephones in service; that the present rates do not justify the increased expense which all night service would involve, and it is therefore necessary to increase the local exchange rates as follows:

One party line business, from $2.25 to $2.50
One party line residence, from 1.25 to 1.50

A discount of 25 cents per month is allowed if the bill is paid at the company's office on or before the fifteenth of the month in which the service is rendered.

A hearing in the above entitled matter was ordered and fixed to take place in the village hall at Cold Spring, Stearns county, on the 29th day of September, at 1:30 p. m. and all interested parties might appear at that time and give evidence for or against the granting of such application. Notice of hearing was given by serving a copy thereof by mail upon the officers of the Northwestern Telephone Exchange Company and by publication in one issue of the *Cold Spring Record* of Cold Spring.

THE GREAT NORTHERN RAILROAD FIRST DENIES AND THEN AGREES TO HAVE A TELEPHONE INSTALLED IN ITS DEPOT AT BAGLEY, WHOSE TELEPHONE PATRONS HAD PETITIONED THE COMMISSION FOR SUCH SERVICE.

The answer by the railroad company to the demand made by the commission and the letter of the Supervisor of Telephones of September 12 to the petitioners reads as follows:

In the matter of the petition of the Bagley Mercantile Company, L. O. Tanjerd, H. W. Nimis, Iver E. Ringdahl and seventy-eight others, for telephone service in the depot of the Great Northern Railway Company at Bagley, Minnesota.

Now comes the Great Northern Railway Company and for its answer to the petition herein, denies that a telephone in the depot of the Great Northern Railway Company at Bagley is a public necessity and convenience or a benefit to the railway company. It alleges that on the contrary, such telephone is not needed by the public and would be an unjustifiable expense to the company.

Wherefore, the defendant prays that the petition be denied.

In the matter of the petition of the Bagley Mercantile Company, L. O. Tangjerd, H. W. Nimis, I. E. Kingdahl, and 78 others for telephone service in the depot of the Great Northern Railway Company at Bagley:

Bagley Mercantile Company, Bagley, Minnesota.

With reference to the above matter, I am directed to advise you that the commission has been advised by the Great Northern Railway Company that it has decided to have a telephone installed in the depot at Bagley. (Signed) J. W. HOWATT, Supervisor of Telephones.

THE WALKER TELEPHONE COMPANY OPERATING AN EXCHANGE AT WALKER, MINNESOTA, MAKES APPLICATION TO INCREASE ITS RESIDENCE RATES OF SERVICE.

Application has been filed by the Walker Telephone Company in which it is alleged that it has recently expended more than three thousand dollars ($3,000) in the converting of its local exchanges at Walker from a grounded to a metallic system and for other general improvements, and in order to secure a reasonable return on the investment and furnish the public with continuous 24-hour service, it is necessary to increase its rates for residence telephone service as follows:

Individual-line residence from $1.00 to $1.50 per month
Party-line residence from 1.00 to 1.25 per month

A hearing in the above entitled matter was fixed to take place in the village hall at Walker, Cass county, on the 15th day of September, at 10:00 o'clock a. m., and all interested parties might appear at that time and give evidence for or against the granting of such application. Notice of hearing was given by serving a copy thereof by mail upon the officers of the Walker Telephone Company and by publication in one issue of *The Walker Pilot* of Walker.

ASSOCIATION NEWS NOTES.

OGILVIE—The West Fish Lake Telephone Company has extended a new rural line to connect with the board at this place.

BRAINERD—The Tri-State Telephone Company has constructed two rural lines to Woodrow and also two lines to Merrifield and Parkerville.

MADELIA—The Northwestern Telephone Exchange Company has a crew here moving its poles and lines off Main street.

DULUTH—A. J. McCulloch, manager of the Zenith Telephone Company, has announced that his company would take its cables off the poles of the electric light company from Eleanor street to 8th street. Also that a new West Duluth exchange will be built within a short time.

LAKE CRYSTAL—The Blue Earth County Telephone Company has broken ground on Main street for its new building.

AITKIN—The Aitkin-Deerwood Telephone Company has just strung two more copper metallic circuits for its toll line between Crossby and Deerwood.

STURGEON LAKE—E. L. McLeon, manager of the Willow River Telephone Company, is rebuilding the exchange here.

ORTONVILLE—The Ortonville-Odessa Telephone Company has started to build its new line east of town.

A Credit Line Omitted

The three central pictures on page 110 of TELEPHONE ENGINEER for September, which showed the telephonic accomplishments of some of our military encampments, should have been credited to the *Bell Telephone News*, from whose accommodating editor the photographs were borrowed. No, he did not bawl us out. This is a spontaneous apology.

When an office worker comes home every night all tired out, it is as likely as not that he has a "snap," and is fighting time.

Economic Conditions and Solutions

The Necessity for More Vigorous Independent Protest Against Bell Tactics

BY TERRY W. ALLEN

THE economic problems of today are fast overshadowing all other conditions and the country, generally, is being forcibly brought to a realization that the next few years is going to bring about swiftly moving changes that are likely to be permanent.

There can be no question that capital and labor are being forced into conflict through short-sightedness on both sides; capital by the former use of power and labor by the present use of power. This condition that has been brought about is a very dangerous one to the United States as a whole because of the fact that the middle-man, the man who is neither a capitalist nor a laborer, is the one upon whom the burden falls. In other words, when we analyze this matter, we find that the great mass of people in this country generally are neither capitalists or laborers, and they are the ones upon whose shoulders rests the responsibility of the next ten years of our national growth. If they are intelligent, if they have foresight and act and assert themselves and demand their just rights (which are just as intelligent and just as conducive to the welfare of the nation as a whole as are the rights of the two extremes of this question), if they will assert themselves, if they will demand legislation restricting both capital and labor, the solution of this matter can be easily brought about; but if the preponderance of any condition brought about by either of the two extremes is allowed to prevail, the middle-man sacrifices his rights, and the country, as a whole, must shoulder the responsibility of such a condition. Therefore, it is absolutely essential that the middle-man take careful notice of conditions that have been brought about through the mismanagement of capital and the grasping tendencies of labor that are directly the results of mismanagement of capital; and upon capital's head the principal blame must be placed, for whatever condition has been assumed by labor to protect itself against the greedy encroachments that in the past were laid upon it by unscrupulous capitalists who sought to "make hay while the sun shines."

There can be no settlement of any of the great momentous questions in this country unless somebody sacrifices something. And in the next few years all will depend upon whether arrogance or common sense governs the two extremes of labor and capital.

Applying this same condition to the telephone business of today, we find that the Bell Telephone Company through its ruthless methods of procedure has striven to drive from the business of telephony all Independent telephone plants in order that it may become the sole dictator of the telephonic problems of the nation; and it has been swayed not by the magnanimous desire to better the telephone service of the country, but to better the pocket books of a few heavy investors. And, consequently, it has brought about a condition that is in a measure similar to the conditions now existing between labor and capital, and the next few years must see a change in the telephone business, or it will see the approach of government ownership.

The American Telephone and Telegraph Company and its allied companies are determined, if they can, to crush the competition that remains, and they have decided upon the present policy through the aid and assistance of a Department of Justice that never did and never has fully understood the telephone problems with which it had to deal. I am firmly convinced of this fact: That had the Department of Justice known what it knows today at the time that the Kingsbury commitment was given, and the suits upon the Pacific Coast compromised, it never would have allowed the American Telephone and Telegraph Company that advantage that it has gained through this lack of knowledge.

I made a statement in a speech in Jackson, Tenn., in 1914 in which I accused the Department of Justice of "taking for granted and not investigating." In other words, I assumed that the American Telephone and Telegraph Company's position was taken in good faith and with the intention of strictly obeying the letter of the law. But that was no reason why the department should not have kept the American Telephone and Telegraph Company in subjection rather than aiding and assisting it to attempt the downfall of Independent Telephony.

In the Department of Justice's report for 1914 that was submitted to the House of Representatives of the United States, the attorney general made this statement:

Of course, the interpretation of the antitrust act on which was based the action taken by the Department of Justice in respect of the Bell System does not mean that where there are two telephone systems in a city or town there never can be a consolidation into a single system. It does mean that where competition has been established in long distance telephony between points in different states it cannot be destroyed by contract or consolidation. This interpretation leaves local communities generally free to have one telephone system, if they desire, subject to the condition that in the event of a consolidation the consolidated company will make connections with all long distance interstate lines and thereby preserve competition in interstate communication.

To a careful observer of conditions, it will be seen that the Department of Justice took sides with the Bell Telephone Company in its position on mergers and that while it made the statement that interstate competitive toll service must be preserved, a community had the right to a monopoly if it saw fit. Consequently the Bell Telephone Company, finding its position generally upheld, has not been slow to take advantage of this condition and has, with leaps and bounds, jumped upon every place that it could make a successful merger and consummated it, or it is in the process of consummation.

I find that this report from the Department of Justice is not generally known throughout the United States, and that very few of the Independent telephone men of the country knew that this was the position assumed by the Department of Justice.

I believe this: The Department of Justice is learning that Independent telephony is not dead; that Independent telephony has rights that two years ago the Department of Justice did not believe existed; and I firmly believe that the Department of Justice will take no steps toward allowing the Bell Telephone Company further to encroach upon the Independent telephone field. And if suits are brought to prevent these mergers from being consummated, I believe that the Department of Justice will and can render service to Independent telephony.

There is one general proposition that is most gen-

erally overlooked in connection with these merger matters. *There is not and never has been any decided protest against the Bell Telephone Company buying up non-competitive plants, and it is along this line that the American Telephone and Telegraph Company has been proceeding without any determined effort on the part of Independent telephony to stop it.* Consequently a number of non-competing and thoroughly Independent plants have been bought out and are now allied with the Bell Telephone Company.

This question is deserving of considerable study on the part of Independent telephone operators, for it is just as surely breaking down Independent telephony as the merging of competing plants, and it is weakening the industry far more, for there are three non-competing plants to one competitive Independent plant..

This question must be studied and some action in connection with this matter must be brought about; to my mind, it is just as much a violation of the law as the purchase of competing property; for it is a tendency to monopolize, and monopoly is a tendency to government ownership.

Bell Improvements in Pennsylvania

According to local officials, the Bell Telephone Company of Pennsylvania has appropriated more than $48,000 for improvement work and changes throughout Scranton and Wilkes-Barre districts.

Of this sum $12,000 will be used in providing twenty-three additional toll circuits in the Scranton district, which will mean the placing of more than forty-four circuits miles of telephone wire. These so-called trunk lines are being provided at this time in order to handle the unusual increase of Bell Telephone toll traffic that has developed during the past three months between Scranton, Wilkes-Barre, Pittston, Wyoming, Hazelton, Tamaqua, Mauch Chunk, Nanticoke, Bloomsburg, Mt. Pocono and other cities and towns in the vicinity.

The remaining amount of the total appropriation, i. e., $36,000, will be used for several changes and additions contemplated for the central office at Wilkes-Barre.

The work planned consists of installing two more sections of switchboard having on each a complement of 800 subscribers' lines, two toll recording sections, new telephone test tables and a new information desk with additional storage battery equipment, other miscellaneous switchboard and terminal apparatus.

All the switchboard lines now available will be, according to a study which has been made of the probable growth of the local office, in full use by the first of the coming year and these additions and changes will not only make the Wilkes-Barre one of the best and most modern in this part of the state, but will provide for the increased Bell growth in Wilkes-Barre for some time.

The work will be started in a short time, say the local authorities, and it is expected that it will be completed within a few months.

Fight Power Lines in Nebraska

A big legal fight between the telephone interests of Nebraska on the one side and the electric transmission companies on the other is expected over the question of who shall pay for changing the aerial equipment of telephone lines when it is necessitated by the placing of transmission lines on the same highways.

Transmission of power for long distances is a product of twentieth century advancement, it is now declared, and telephone companies must arrange to meet the changing conditions. As a result, both sides are preparing for a contest to determine who must pay for the cost of changing the lines.

Dunwoody Institute to Have Telephone Course

The Dunwoody institute at Minneapolis, Minn., is developing ambitious plans for the education of telephone workers. Because of the attention attracted when courses were offered in the night classes of the school, the subject is being taught in the day classes, while extension courses for out-of-town students are being arranged.

The institute is having the co-operation of the Northwestern and Tri-State Telephone Companies. O. D. Johnson, an expert engineer, who was until recently employed by the former company, has been employed as teacher.

After one year's work in electricity as a foundation training, boys are permitted to elect telephone work for their second year of instruction.

At the close of the second year of work in the school the boys are placed with the telephone companies of Minneapolis and St. Paul at a wage of not less than $10 a month. When they have had one year of successful experience they receive a diploma in telephone work from the school.

The Northwestern Telephone Company was so pleased with the effect of the evening school training upon its workers last year that the company has arranged for an evening school under the auspices of the Dunwoody institute of the city of Duluth, the company paying all the expenses of this course.

In all, 17 different courses in telephony are offered by the school, as follows: General science of telephony, mathematics of telephony, sub-station courses Nos. 1 and 2, private branch exchange courses Nos. 1 and 2, cable courses Nos. 1 and 2, exchange aerial construction, exchange underground construction, toll line construction, central office equipment courses Nos. 1, 2 and 3, central office power plant and testing courses.

Contracts for the construction of two buildings to serve as the first of a group were let recently by trustees of the Dunwoody institute. The structures are to be unique in construction, for no set partitions will be used, the interior being so arranged that partitions may be put up or taken down as the needs of the institution demand.

Howler Hurt His Ear

A peculiar accident is alleged as the basis of a $10,000 damage suit against the Cincinnati and Suburban Bell Telephone Company, and the Union Central Life Insurance Company, by Monroe Izor, flour merchant of Cincinnati.

Izor declares that on October 20, 1915, employes of the Union Central washed the walls of his office, and water ran down the telephone wires, causing a short circuit. Izor says that he notified the telephone company, and the employes of that company put on the "howler" while he had the receiver pressed against his left ear. The result was a severe shock to his ear, which caused "herpes zoster" to develop, and he was confined to his bed for 19 days, Izor declares.

Since then he frequently suffers pain in the ear, Izor alleges, and he says that he has lost much time from his business.

European Telephone Development

Translations from the Foreign Press and Communications from European Engineers

BY FRED W. SCHOLZ

AN account appears in *Annales des Postes, Telegraphes et Telephones* of an investigation made by John Hesketh, an Australian telephone engineer, of operating expenses of automatic and manual telephone exchanges from observations made on numerous trips in Australia and the European continent.

The author made several trips, in the year 1904 and then again in 1913, to study the latest development of foreign telephone practice for application in Australia. In doing this he naturally made comparisons not only in regard to technical equipment but also operating expenses as well.

He comes to the conclusion that in time the manual telephone system will be replaced by the automatic system, although that is still in the far future. For larger telephone systems, however, he found the automatic system preferable. The operating expenses, except for the charges for interest, depreciation, sinking fund, are much less than for manual systems. It was as a result of these studies that he favored the installation of an automatic system at Geelong in Australia, a small isolated center, which would give the automatic system as severe a test as could be imagined. The results obtained bore out all the expectations of the author. He found that if the operating costs of this telephone exchange were to be set parallel to those of other manual exchanges of the same size and working under the same conditions, the automatic system offered a saving in expenses of about ten per cent.

OPERATING EXPENSES OF TELEPHONE EXCHANGES, MANUAL AND AUTOMATIC

In order to give an estimate of costs, one can take as a basis an average number of 10 calls per day per telephone line.

The twenty-fourth of August, 1915, this number in the city telephone system of Sydney rose to 10.7 and in the entire telephone system it was 6.8. If then the average number 10 was taken as a representative number for an urban telephone system of about 5,000 lines, it may be seen that this is not exaggerated and will give a fair basis for comparisons. It may also be assumed that the number of telephone calls during the busiest hour of the day might be set at one-eighth of the number of calls per day.

In order to favor the manual system it has been assumed that the maximum amount of work done by the A-operator was 225 calls during the busiest hour of the day, and that the B-operator made about 400 connections. The totals of the number of connections during the busiest hour, and the total traffic, both at Sydney and at Melbourne, are at the present time about 1/1.6. The expenses of line construction need not be figured in this comparison, as they are practically the same for both systems. Nor have the administration and management or office expenses been entered, as it is the intention to show in the main the economy offered by automatic switchboards. However, it seemed useful to give the interest charges, as also the charges for sinking fund and depreciation, and the figures given in the following table represent the average experience of the most common size exchanges. The first costs of installation for a telephone system of about 5,000 lines may then be estimated in the following manner:

	Automatic.	Manual.
Buildings	$ 23,376.00	$ 32,629.00
Equipment of exchanges	219,150.00	103,487.00
Installation of subscribers' apparatus	103,487.00	66,963.00
Totals	$346,013.00	$203,079.00

The expenses for the building fund are naturally higher for central exchanges of the manual system, as more space is needed for the operators and the staff. The second column, "Equipment of Exchanges," includes all necessary office space, rest rooms, etc., and is taken from actual figures furnished by Australian company reports. The following table gives the installation costs for a system of 10,000 lines:

	Automatic.	Manual.
Buildings	$ 46,265.00	$ 58,440.00
Equipment of exchanges	438,300.00	231,325.00
Installation of subscribers' apparatus	206,975.00	133,935.00
Totals	$691,540.00	$423,700.00

It is clear that the cost per line, in the case of the manual exchange at least, increases with the importance of the manual switchboard and with the increase in cost of that switchboard. The cost of maintenance is about as follows:

TELEPHONE SYSTEM OF 5,000 LINES.

	Automatic.	Manual.
Maintenance costs of exchange	$ 19,480.00	$ 21,915.00
Maintenance of subscribers' phones	11,834.00	10,958.00
Operating expenses	1,607.00	48,700.00
Upkeep of buildings	195.00	273.00
Depreciation and interest:		
Installations at exchange	20,147.00	9,511.00
Installations at subscribers' telephones	14,800.00	9,579.00
Fixtures	1,090.00	1,519.00
Totals	$ 69,153.00	$102,455.00
Approximately per line	$13.83	$20.50
Annual difference per line in favor of automatic system		$6.67

TELEPHONE SYSTEM OF 10,000 LINES.

	Automatic.	Manual.
Maintenance of central equipment	$ 38,960.00	$ 43,830.00
Maintenance of subscribers' telephones	23,668.00	21,815.00
Operating expenses	2,371.00	96,260.00
Upkeep of buildings	390.00	487.00
Depreciation and interest:		
Installations at exchange	40,294.00	21,262.00
Installations of subscribers' telephones	29,600.00	19,143.00
Fixtures	2,156.00	2,722.00
Totals	$137,439.00	$205,519.00
Approximate cost per line	$13.74	$20.56
Annual difference per line, in favor of automatic system		6.82

The maintenance costs of the subscribers' telephones would be the same in both systems if, in the automatic system, the subscriber were not supplied with a number dial disc for calling. In all other respects the apparatus is the same, consequently the only difference to be considered is the upkeep of this numbered dial for making of calls. As concerns the upkeep of buildings, the figures of the Australian Department of the Interior have been taken. In both comparisons moderate values have been used, so that the differences given represent the minimum charges that one might reasonably expect. Certain of the automatic companies claim that their maintenance expenses can be reduced to one-half of those quoted. That is, however, a doubtful fact, and figures have been taken based on Australian and European experience, and the greatest reduction that might be assumed under very favorable conditions is about twenty-five per cent.

The life of the two systems has been considered as the same. This supposition favors the manual system, although it is the opinion of the author that the automatic system is the more durable. As regards this question, he calls attention to a report issued by the Automatic Electric Company of Chicago, where the statement is

made that the automatic system has by far the longer life of the two. It is his private opinion, however, that the difference in the life of the two systems is at most ten years, if that much. As experience has not given us any reliable data on that head, it is best to assume that the life of the two systems is the same.

In 1911 a group of English telephone engineers visited America to study the installation costs of an automatic telephone system in comparison with a manual one. The results of these investigations may be summarized briefly as follows:

	Automatic.	Manual.
Expenses for a system of 500 lines.....	$ 3,185.00	$ 3,414.00
Expenses for a system of 5,000 lines.....	29,658.00	43,767.00
Expenses for a system of 10,000 lines.....	59,317.00	95,769.00

It may be stated that these figures are much more favorable to the automatic system than those given in the present comparison.

Attention must be called to the fact that the expenses of a manual system grow with the importance and the size of that system. The automatic system within certain limits gives a better picture. Moreover the conditions are slightly different, depending on the question whether all the subscribers are connected to one exchange by long underground cables or the ordinary telephone wires, or whether they are connected to a number of nearby exchanges, which latter fact would tend to reduce the cost by the expense for the more expensive longer cable. In a well placed automatic exchange one can make all the extensions necessary without increasing the purchasing cost for cable material to any large extent. This is not possible in a manual exchange. The average physical standard of the manual operator, moreover, has a great influence on the efficiency of the manual operation of telephones, a factor which of course drops out of consideration in automatic exchanges. One can also install an automatic exchange in a much smaller space than that necessary for a manual system. This is a result of the fact that the apparatus needed to make an automatic connection takes much less room than does the equipment needed for making a manual connection.

In the latter system the installation costs of exchanges increased with the number of exchanges established, a fact which does not apply to the automatic exchanges, or at least not to that degree. In the case of the latter, any increase as a matter of fact adds very little to the general installation expenses, and can even be figured as a reduction in costs, when the added revenues from greater service facilities are considered. In general the expenses per line, when the latter have reached a certain number, are constant and invariable, and this is without doubt an advantage of the automatic system.

As regards the working of the automatic system and the satisfaction of subscribers, the report of Mr. Howson of the Geelong automatic exchange might be quoted. The Department of the Interior was told that certain subscribers were dissatisfied with the poor service, and as a result Mr. Howson was ordered to make a thorough investigation of these charges. The author visited the Geelong exchange and can only affirm the findings of Mr. Howson. Among twenty-six large business houses consulted, all of them with large automatic interoffice exchanges, only two made complaints, the others stating that they were satisfied with the service and would not go back to the old manual system. After reading the report of Mr. Howson and after personal investigation, the author came to the conclusion that the automatic system was satisfactory. It might be added in closing that the Sydney telephone system is being changed over to the automatic system, and that the majority of the subscribers have adapted themselves to the new system without much fuss and have shown by the absence of complaints of poor service that they appreciate the new system and are keeping step with the progress of telephone engineering, a fact which can not as a rule be claimed in most instances.

THE SEMI-AUTOMATIC TELEPHONE EXCHANGE AT ANGERS, FRANCE.

In 1912 the Under-Secretary of the Department of Postal, Telegraphic and Telephone Service decided to install semi-automatic telephone service in the cities of Angers, Marsaille, Nice and Orleans. The work of installing the new system was almost finished at Angers when the war broke out in 1914. In spite of the depletion of operating and mechanical staff at Angers, this installation was finished in November, 1915, and was operated that same month. The change from manual to semi-automatic service was accomplished without trouble. Fourteen hundred subscribers are connected to the exchange, whose total capacity is 3,000 subscribers and which has been housed in an exchange building large enough to increase to a final capacity of 20,000 subscribers. The *Annales des Telegraphes et Telephones* give an excellent description of the mechanical working and operation of this system, which will be reproduced in various installments in these columns of TELEPHONE ENGINEER, as the original article is too long to be given in one issue. The present issue will cover two parts of this new exchange, namely, the wiring diagram and equipment of the supervisor's switchboard and the testing table and testing methods.

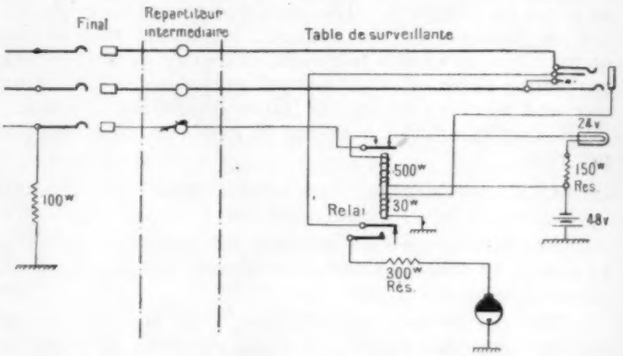

Fig. 1. Telephone Line Coming from the Automanual Exchange.

Circuit of Supervisory Table.—At Angers the supervisor has the duty of watching service and giving information to subscribers, and to her are referred all complaints as also questions of information on the part of subscribers. Fig. 1 shows the wiring diagram of the telephone lines coming from the exchange and the supervisory table.

The supervisor's table is provided with telephone lines coming from the exchange connected to the same line over the final selectors of any one group, whose multiple wires have been removed. If a question is asked of the supervisor, the semi-automatic operator presses on a key, which lights up a lamp of 24 volts and connects the subscriber to a free wire at the supervisor's table. The supervisor answers by placing a single cord in the jack corresponding to the lighted lamp. The battery of the third wire operates the relay with its two windings or coils, which cuts off by way of its own working contact and the resistance of 100 ohms of the last selector. The lamp goes out. When the conversa-

tion is finished the supervisor in drawing out her plug connects the lamp cut-off contact to the conductor of the telephone line, which produces an interruption in the circuit to the lamp and extinguishes the supervisor's lamp. The semi-automatic switchboard operater knows then that the conversation is finished.

In case the subscriber wishes to be connected to another subscriber, the supervisor makes use of one of a pair of cords (Fig. 2) and calls the subscriber by placing her calling plug into an outgoing jack having wires leading to the semi-automatic exchange switchboards. These outgoing jacks are connected to a group of primary contact fingers or seekers, which transfer the call to a regular operator.

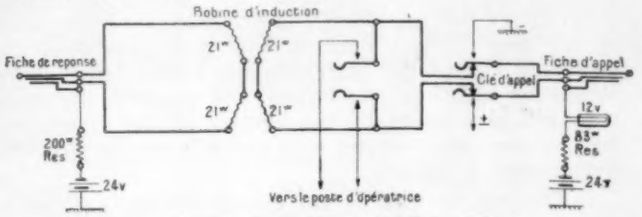

Fig. 2. Diagram of the Circuit of a Pair of Cords.

The supervisor can listen over her wires in order to make sure that the conversation has started. In drawing out her plug she finishes the operation as far as this call is concerned. The supervisor has at her table a single answering cord which she uses to speak to a subscriber connected to her table. A key protects the line temporarily against interruptions. This single cord is also used to inspect a line. The circuit of the pair of cords, shown in Fig. 2, is used by the supervisor to make connections as described above. In addition her table has also call lines used to receive direct calls from the testing switchboard and from the long distance switchboards. When a call is received, the calling relay is cut off and lights the call signal lamp. When the operator inserts her answering plug, the grounded connection is cut off from the jack contact and the lamp goes out. A special outgoing line call is used by the supervisor to call the test switchboard, the long distance operators or a subscriber.

A supervisory line or a line connecting with the semi-automatic exchange switchboards has its ends in the jacks of the supervisory table and leads to intermediate distributing boards, from where connection can be made with any line. To watch a certain line the operator uses a single answering cord and presses down her supervisor keys (Fig. 3) and listens in. The supervisory key cuts off the transmitter and connects the receiver in series with the condenser and an induction coil of 300 ohms.

The observation of service over the various wires is done over lines terminating in the supervisory table in various jacks and in two call signal lamps, which end in the intermediate distributing board. They are connected to the subscribers' lines, whose service is to be studied by means of cords, ending in hook terminals. A calling lamp corresponds to the calls made by the subscriber and another lamp to the calls received by him, so that it is easy to make comparisons.

When a subscriber calls, his line relay attracts his armature, which closes the current circuit over the starting relay, across the resistance of 200 ohms and in shunt with the resistance of 600 ohms over the contact *D* across the winding of 1,000 ohms of the block relay. The call lamp of the subscriber's calling line will then light up. When the supervisor places her plug of the single cord into the proper jack the light goes out.

When a subscriber is called by an exchange operator a shunt of the call current passes to the block call relays, connected in shunt over wires *A* and *B* and the lamp corresponding to the call received lights up. This lamp is extinguished when the supervisor places her plug into the supervisory jack.

Circuits and Methods of the Testing Table: Test Circuit of the Voltmeter.—(Plate VI, Fig. 3.) The testing circuit terminates in test plugs and comprises the following keys:

1-4. Keys to place the various test plugs into the circuit.

5. Key allowing interior and exterior tests to be made. In its normal position, when a plug is placed in a line to be tested on the general distributing board, it allows relays of 200 ohms to operate and to make exterior tests. On the contrary, when the key is pressed down, the relay does not operate and interior tests can be made. When keys 10 and 12 are pressed down the working of this key destroys the connection between the voltmeter and the top of the test plug, which places the entire system in series with the battery of the exchange and the battery of the test table.

6. Inversion key, which allows the inversion and interchange of two wires of the telephone line with respect to the testing circuit.

7. Calling key.

8. Grounding key. Pressed down, it connects the tip of the test plug to earth. It is used for tests with the voltmeter and the call bell relay.

9. Bell relay, used to connect the testing relay and a bell to one branch of the line, when it is desirable to obtain signals that can be heard at a distance.

10. Voltmeter key, used with the following keys:

12. Loop key: in its normal position it connects the positive pole of the test battery to the ground; when it is pressed down it connects this pole to the tip end of the test plug.

13. Cut-off key of the testing battery: when pressed down, it connects the voltmeter directly to earth when it is desired to measure the external potentials.

14. Inversion key of voltmeter: pressed down, it inverts the connections of the voltmeter in respect to the line to be tested. It is used commonly with the cut-off key of the voltmeter for tests of external potentials.

15. Shunt key of voltmeter: pressed down, it reduces the effective resistance of the voltmeter from 10,000

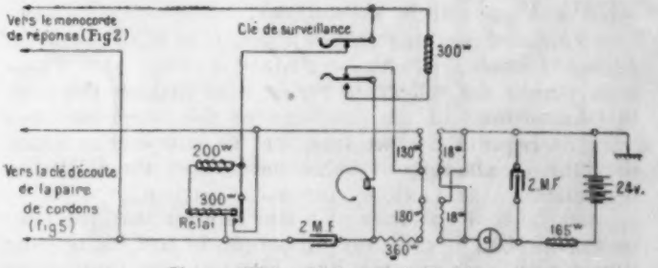

Fig. 3. Wiring of Operator's Position.

to 400 ohms for measuring resistance of telephone lines.

11. Ringing key, used to call lines of subscribers who have left their receivers off the hook.

16. Battery key: in its normal position it connects a self-induction coil in shunt with the testing circuit; pressed down, it cuts off this shunt and connects the 24 volt battery to the testing circuit in order to feed the stations of the subscribers connected to this circuit.

In most of the type of apparatus used here, the testing circuit is provided with the following cords:

Grounding Cords.—The cord of the first position at the table has its ends connected to earth (grounded), that of the second position has its conductors connected to earth. These cords are used to ground one or the other branch of a telephone line.

Sounding Cords.—These are used to connect the relay and the bell signal to the one or the other branch of the line to try whether audible sound testing is necessary. The tip of the plug is used for the first position and the body end for the second position.

Connecting Cords.—The connecting cords, as shown in Fig. 5, are used to connect two telephone lines. This pair of cords is connected with a calling key, a listening key and a supervisory lamp.

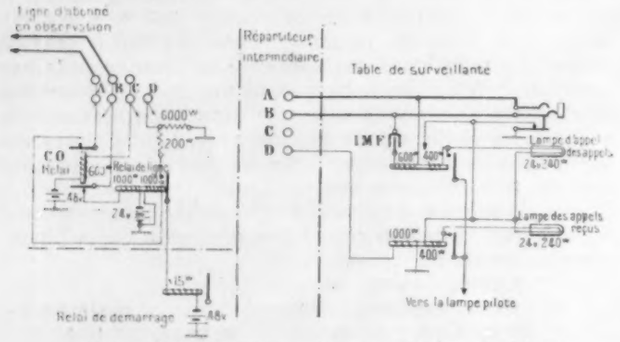

Fig. 4. Diagram Showing Study of Service on the Lines.

Test Lines to General Distributing Board (Plate VI).—This circuit, multipled in its two positions, is provided in each position with a jack, which permits interior or exterior tests to be made. In placing a test plug (Plate VI) into a jack, the 200-ohm relay is operated as has been shown before, which allows exterior tests to be made. The relay in attracting its armature connects one of its contacts to earth. A block calling relay is placed in shunt with the line in such a way so as to receive the calls coming in on this line during the tests. When the key *5* is pressed down, the armature of the 200-ohm relay falls back into position. The testing plug is then connected in the inside branch of the line to be tested. As this circuit is employed for tests of short duration, no provision has been made to receive calls that might come in on the line to be tested during the tests. For longer tests a return circuit is used (Plate VI, Fig. 1), as will be shown later.

Testing Lines and Return Circuits to the Interurban (Long Distance) Table.—(Plate VI, Fig. 1). These lines permit the telephone repair man making the tests to take account of the condition of the telephone lines being tested at the same time that he is trying to locate the faults. The circuit can be used under the following conditions:

If the terminal wire of a line is grounded, the telephone line will give disturbing noises: to test the line the repair man will ask the long distance operator taking care of the testing plugs to insert one of her plugs in the multiple jack of the subscriber's line. The electrician will then place one of the plugs of the test circuit in the return jack and will determine the location of the fault. He will then withdraw the test plug and will leave the switchboard key, corresponding to the return jack in the normal position. If the subscriber calls while the line is thus connected to the test table, he will operate the relay with its two 200-ohm windings and will light a calling lamp corresponding to the return jack to which his line is connected. The repair man can then insert a testing plug, and by using his battery key *Nr* 16 will be able to talk with the subscriber. If the latter desires a call, the repair man can make use of a pair of cords (Fig. 5) by inserting the answering plug in the return jack and the calling plug in a jack of a line going out to the exchange switchboard. These lines are then connected to a group of primary selector arms, which transfer the call to a regular operator. The repairman can watch the conversation by means of his listening key; when the same is ended, he will inform the operator of the end of the conversation by breaking the connection.

If the conductor of a line is grounded or if the two wires of the line are short circuited, the relay of the subscriber's line remains attracted. The testing repair man will call for the subscriber's line, connection being made by the long distance operator and will press down the switching key of the corresponding return circuit wire. When the fault has been located and repaired, the repair man will give notice by the lighting of the supervisory lamp of the return circuit wire and will set the switching key in the rest position.

The testing wire of the return circuit is grounded by way of a 50-ohm resistance and across the winding of a trouble-testing coil. When the plug of the return line has been inserted in the multiple jack of a subscriber's line, the cut-off relay *COR* of this line will operate and will prevent the line from being connected to the primary selectors. At the same time the multiple jacks of the line tested are plugged so that the operators cannot use them.

Line Coming from the Semi-Automatic Exchange.—The testing table is provided with lines coming from the semi-automatic exchange tables. These lines are connected to contacts of the same line by way of the last line selectors of the same group whose multiple wires have been stopped temporarily. If a connection is desired by the repair man, the semi-automatic operator will press down on the key marked *8* of the thousand series. This will light the call lamp of one of the free lines at the testing table. The repair man answers by inserting his answering plug in the jack corresponding to the lighted lamp. He connects then the winding of a 500-ohm relay to earth by way of the 150-ohm resistance of the jack and the 50-ohm resistance of the third conductor of the plug. The 500-ohm relay in attracting its armature, puts out the lamp and is blocked by way of the 100-ohm resistance of the final selector. When the repairman withdraws the plug the lamp cut-off is connected to the

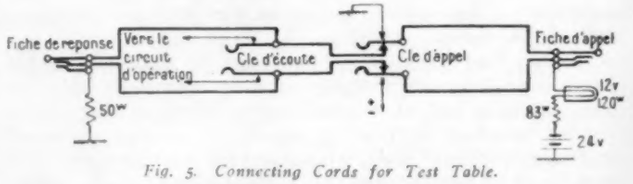

Fig. 5. Connecting Cords for Test Table.

conductor wire of the line and consequently the current is interrupted periodically in the supervisory relay S_2R, which produces the flickering of the supervisory lamp. The operator can then break the connection and the 500-ohm relay will return to the rest position.

By means of testing jacks to the long distance lines the repair man can test any line either inside or outside of the exchange and listen to the conversation for trouble. Call lines coming in from subscribers are used to receive calls either from the regular operators or from the supervisor. Each line is provided with a call lamp which is

lighted by the action of an disc relay. When answer is given, the armature of the relay is attracted and the light extinguished. Outgoing lines towards the exchange tables are used by the repairman to communicate directly with the supervisor or to make connections with a subscriber whose line is connected to the testing table, as was explained previously.

Testing Methods.—All the tests are made with the testing circuit of the voltmeter. A testing circuit is provided for each position at the test table. The table can be connected either to the general distributing frame or in multiple. The tests over the distributing board are generally very short in duration and allow localization of faults as "internal" and "external" faults. The tests of longer duration are made over the return circuit lines.

Insulation or Grounding Tests.—Pressing down keys 1, 2, 3 or 4 corresponding to the cord used and the key 10 by connecting earth to one of the wires of the line by means of key 8 and by making a grounding test on the other wire by means of key 10.

Resistance Test.—Resistance can be measured in placing it in series with a voltmeter of a known resistance and a batery of known voltage. The deviation of the needle of the voltmeter will be as feeble as the resistance is greater. The external resistance will be equal to the product of the resistance of the voltmeter by the difference between the voltage of the battery and the deviation of the needle recorded during the test divided by the deviation, or in other words:

$$R = V \times \frac{(E-D)}{D}$$ where R = the external resistance.

V = the resistance of the voltmeter.

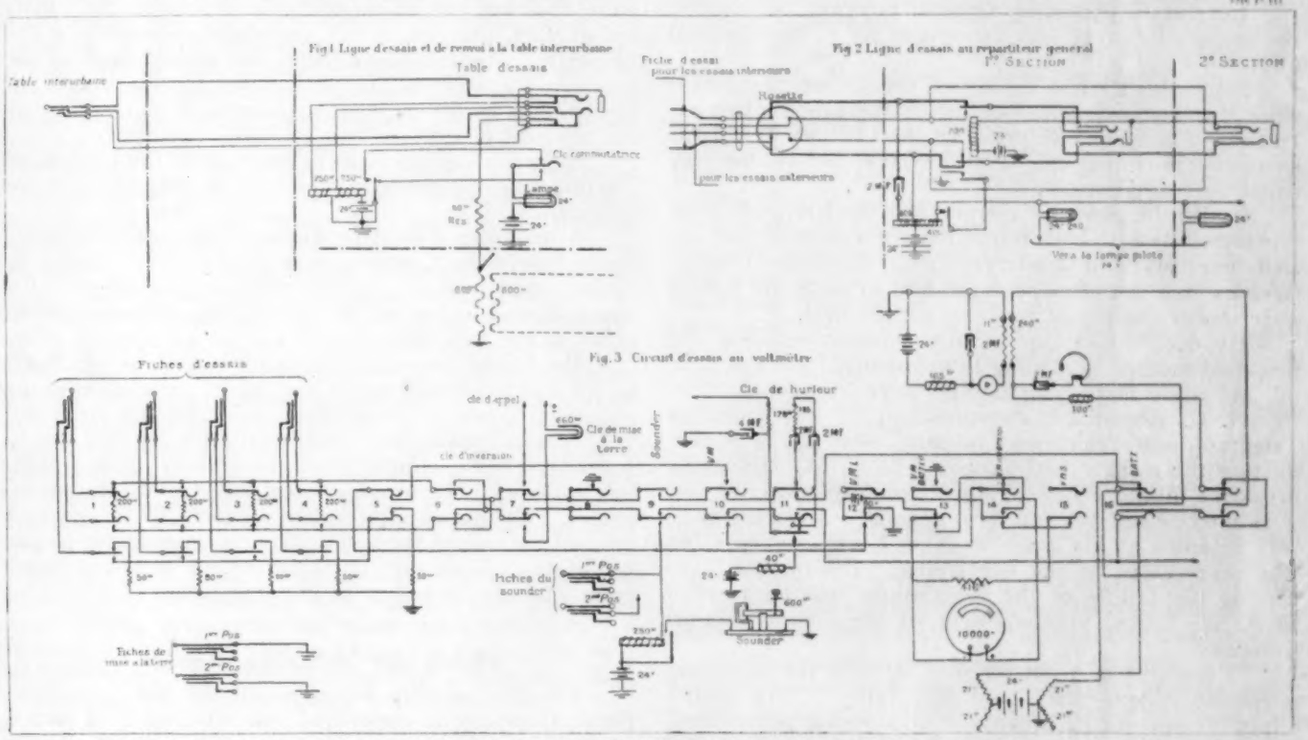

Plate VI. Detail Wiring of Test Table.
Fig. 1. Testing Lines and Return Circuits to the Long-Distance Table.
Fig. 2. Testing Lines to the Main Distributing Frame.
Fig. 3. Testing Circuits to the Voltmeter.

of the voltmeter; the positive or negative side of the conductor is thus tested. If the losses in the line are sufficiently large one can obtain an audible signal by pressing down the signal key 9 instead of key 10. This testing method is very rapid. It is possible to regulate the relay controlling the bell in such a way that it will react as soon as the insulating resistance of the line is not sufficient to assure the working of the apparatus at the exchange, giving therefore a negative result, which means that everything is as it should be.

Continuity Test.—These tests can be made in two ways: 1, pressing down the key of voltmeter 10 and the key of loop 12, which results in placing in series the line and the voltmeter with the testing battery; 2, pressing down key 10 of the voltmeter and then grounding key 8; in this case earth is connected to the extremity of the loop by way of the testing table. This test may be preceded by a test for grounding in order to make sure that there is no grounding on one or the other line.

Short Circuit Test.—A short circuit can be tested

E = the voltage of the test battery.

D = the deviation of the voltmeter needle during the test.

The voltmeter of the testing table has a resistance of 10,000 ohms. When the shunt key is pressed down its effective resistance is reduced to 400 ohms.

Ballistic Tests.—This test serves to determine approximately the capacity of the line and of the condensors used. The test is made by pressing down the key of the voltmeter 10 and by working the inversion key 6 rapidly; each movement of this key makes a change of the needle of the voltmeter. The condensor of a subscriber's station will under these conditions give a deviation which is almost constant and any deviation differing from this constant will mean a fault. Account must be taken of the fact that if the line is very long or if more than one condensor is used, the deviation is different. Over very long lines the variation between a normal

deviation and an abnormal one can give an idea of the location of the fault in the line. In short lines the side or under tone in the receiver, when one speaks into the transmitter, will give an indication of the distance at which spot the line is open.

Tests to reveal stray currents and ground potentials are made by pressing down the cut-off key of the testing battery 13 and the key of voltmeter 10 and if necessary the inversion key of the voltmeter. Before making this test it is advisable to make sure that the external voltage does not exceed the scale limit of the voltmeter.

Chicago Merger Deal All Off

Purchase of the automatic telephone system of the Illinois Tunnel Company in Chicago by the Bell interests was given up September 20.

Refusal of Attorney General Gregory to approve the proposed merger was the reason for calling the deal off.

September 21 was the last of the six months' period since the city ordinance permitting the sale became effective. The ordinance provided the Chicago Telephone Company must pay the city $500,000 before the sale could be consummated.

In Washington the merger was declared off after representatives of both the automatic company and the Bell interests had conferred with Attorney General Gregory in a last attempt to get him to place the federal government's stamp of approval on the deal.

He declined to express any opinion regarding the proposed merger, according to a dispatch from the capital, and consequently negotiations were stopped.

N. C. Kingsbury, vice-president of the American Telegraph and Telephone Company, who has been conducting the merger negotiations with C. W. Hotchkiss, president of the Illinois Tunnel Company, was the one who interviewed the attorney general. Mr. Hotchkiss was detained at his home in New York by illness but was represented at the conference. Information concerning the failure of the negotiations was telegraphed to S. W. Tracy, vice-president of the Illinois Tunnel Company.

"I don't know what we shall do with the automatic telephone system now," said Mr. Tracy. "We cannot afford to operate it, because it is a losing proposition. I do not suppose that any decision will be reached until the board of directors meets. When that will be I do not know.

"The conferences with the attorney general have been going on most of the summer. At the final one he declined to express any opinions as to whether or not the government would approve the merger. The Bell people, consequently, would not purchase the system. That was the only reason for their refusal to buy the plant.

"The three-year contract to buy the automatic system expired on July 31, but the Bell interests have shown a disposition since that time to buy if arrangements could be made. One of the provisions of the contract stated that the sale must be approved by the government authorities."

Refusal of the Bell interests to buy the system will place the question of the disposition of the property before the city council once more.

The ordinance permitting the sale was passed by the council on March 11 of this year by a vote of 46 to 22. Under the terms of the ordinance the tunnel company was enabled to sell the automatic system to the Chicago Telephone Company for $6,300,000.

It was stipulated in the measure that not more than $1,532,058 should be added to the capital stock of the Chicago Telephone Company following the absorption of the automatic plant.

Alderman Lewis D. Sitts, chairman of the council committee on gas, oil and electric light, planned to call a meeting of the committee for the purpose of taking steps to bring about the forfeiture of the franchise of the Automatic Telephone Company as a result of the failure of the Bell interests to pay over the purchase price.

"A misconception seems to prevail in connection with the automatic telephone matter," said Alderman Sitts. "The popular belief is that all the city has to do now is to jump in and seize the property of the automatic company, and then go into the telephone business. As a matter of fact, the city is not permitted to confiscate the property. The forfeiture means the taking away of the company's franchise. It is a matter for the courts, in my opinion, to decide what disposition is to be made of the physical properties."

A plan of action is to be decided at the committee meeting, and the entire matter is to be taken before the council.

A determined fight between the city and the Automatic Telephone Company was predicted by Walter L. Fisher, who was special counsel for the city in the negotiations looking to the sale of the automatic properties to the Bell interests.

Mr. Fisher was informed that the check for $500,000 which was to be paid to the city for its permission to the automatic company to make the sale had not appeared.

"Undoubtedly the whole matter will have to be fought out in the courts," said Mr. Fisher. "I had nothing to do with the proposed deal between the two companies. My duties were solely advisory to the city. I advised the sale of the automatic properties under proper conditions. Then my duties ceased. I have not heard from officials of either of the companies."

Holds the Nebraska Record

The Central City Exchange of the Nebraska Telephone Company is considered comparatively the largest in the northwest states. That is, the number of stations on its switchboard per the number of houses in town is greater than any board in Nebraska and adjacent territory.

At the present time there are slightly more than twelve hundred telephones connected with the local exchange. These represent the business telephones, residence telephones, local party lines and lines which extend into the country.

Omaha, itself, has a larger percentage of telephones than the Central City exchange but the large number of private branch boards is what makes that exchange comparatively larger.

The local switchboard has six positions or sections, two for toll work and four for local work. It has long distance booths at the exchange and toll stations at the hotels and the Conservative State Bank.

Those in charge of the Nebraska Telephone Company in Central City are: Manager H. C. Wells; wire chief, Frank Wilson; chief operator, Ellen Nelson; assistant chief, Ruth Morris. The company has twelve operators.

Transcontinental Telephone Demonstrations

One Hundred Seventy of Them and What They Have Accomplished — from the Pacific Telephone Magazine

BY HENRY G. BATES

JULY 1 witnessed the last transcontinental demonstrations which had been running under the auspices of the Pacific Telephone and Telegraph Company since December 15, 1915, following the closing of the exposition.

We look back upon these demonstrations with great satisfaction, confident that the resultant benefit to the telephone business has been far in excess of our expectations. During this period of nearly seven months we have made approximately 170 hour-long telephone excursions to distant cities averaging better than one for each working day. Fifteen cities in three Pacific states have exchanged greetings with ninety-nine cities in twenty-nine other states between the two oceans. Upwards of 75,000 eastern people have heard our voices and 12,000 listeners at this end of the circuit have heard their responses. Of these 7,500 represent the attendance in San Francisco alone, 6,000 being guests at outside gatherings and 1,500 at the demonstration room in the Bush street building. These figures do not include an audience of 10,000 at the Civic Auditorium when Marshal Hale announced to Miss Mabel Boardman in Washington the result of the campaign to increase the membership of the Red Cross, as receivers were not provided on that occasion.

In all this period there was but one failure, and that was not altogether a failure, as the San Francisco audience heard Mr. Kingsbury call the roll over a remarkably clear circuit all the way from New York to Winnemucca, including the call for San Francisco. Before the San Francisco wire chief could answer, a group of twenty tall trees in the Sierras, overborne by snow, ice and wind pressure, went through the line and it was all over for that night. The keen disappointment was tempered with appreciation of the impressive roll call and its dramatic finish. It is a gratifying and remarkable record of which the plant officials should be very proud. They admit it.

It has been a campaign of education. We have conducted a telephone training camp in which long range talking has been taught as a gentle art. A long roll of accomplished telephone talkers has been develepod. They have learned that the telephone is non-combatant, that it is not to be shouted at in nervous terror but approached in a spirit of confidence and wooed in softer tones. Experience has taught that it will respond to kind treatment and with a fair chance will perform its appointed task.

A very broad field has been covered. Every business, every civic, social, charitable, religious, and political activity has been represented in these gatherings. We have heard the booster talk of the Rotarians, the series business statistics of chambers of commerce and boards of trade. We have heard Edward Rainey, the mayor's secretary, conduct both ends of a conversation with credit to himself and the man at the other end. With 1,500 for company, we have waited all night to hear Caruso's voice in far-away Atlanta, Ga., at four o'clock in the morning. We have listened with becoming respect and awe to the polished English of the country's educators and to the erudite discussions of doctors of science. We have enjoyed the josh and jolly of doctors of law and doctors of divinity. With numerous alumni we have assisted uproariously at college reunions and celebrations. Under the martial exhortations and warnings of the army and navy we have waxed enthusiastic on the subject of universal military training. We have joined in the felicitations exchanged between women's clubs on suffrage attained or prospective. Within our hearing, political leaders have outlined the policies of parties, have dwelt upon our sins of commission or omission, and have prophesied touching the destinies of the nation. Peace talk, preparedness talk, always, from everybody.

Comfortably conscious of our place in the sun, we have listened tolerantly to the skeptical witticisms of the storm bound, freezing, roasting, humid, sizzling East aimed at our incomparable California weather. In the roll call we have heard the genial voices of the wire chiefs, alert and cheerful under all circumstances, and have been made aware that a transcontinental wire chief's job is no place for a man with a grouch or a flea-bitten disposition. We have laughed with our assembled guests 170 times over Winnemucca's Indian population and its geographical relation to Reno, over Denver's elevation, physical, moral, and otherwise. The Atlantic has roared its greeting and the Pacific has roared response.

Our sympathies have been enlisted by the intimate greetings of parents and children, brothers and sisters, usually gay, often incoherent with emotion. These informal talks, with the human touch to which all men respond, relieved the tension which marked the opening of every demonstration, and it was noticeable that the most successful occasions were those which were signalized by these incidents of pathos or humor.

One occurrence impresses itself strongly. During a conversation with one of the smaller eastern cities a few days before Christmas a young bride in San Francisco talked with a favorite uncle who was at the eastern gathering. They were manifestly very fond of each other, both were witty, and their cheerful repartee was the success of the evening. Much was said about a Christmas box received by the niece, which she threatened to open despite the injunction not to do so until Christmas morning. Two days later we were told that the uncle had died within a few hours; that the Christmas box was still unopened, and that that last talk was a wonderful thing of incalculable value to be treasured always in the memory.

Apropos of woman suffrage and politics: On one occasion a San Francisco woman leader, known to all advocates of the cause, in conversation with a prominent Chicago woman was asked if, at the approaching Chicago convention, she would deliver the vote of the California delegation for a certain candidate for office. After ascertaining the size of the Illinois delegation, she stated that California would support the candidate, provided the Illinois delegation would vote for the California candidate for president of the National Federation of Women's Clubs. The bargain was eagerly concluded on the spot. It was then brought

out that the Illinois delegation would deliver 200 votes for California's seventeen. This will serve to enlighten any doubting mind concerning the political acumen of the California suffragists.

For the high quality of our gatherings we are largely indebted to the San Francisco spirit of helpfulness toward any enterprise which redounds to the credit of the city. Time and again, at great personal inconvenience, leading men and women of San Francisco's business and social world have postponed engagements and have come dinnerless to the demonstration room for the purpose of talking with people in the East. And now we know that these people, their friends, and their friends' friends are friends of the telephone company. To name them would require a reprint of "Who's Who" and the Social Register, together with the membership list of the clubs and all other organizations prominent in the life of San Francisco. We are confident that the same satisfactory relations exist wherever the opportunity for personal contact and mutual understanding has been offered by this use of the transcontinental line.

Through the whole course of these demonstrations has run the knowledge that a great work was being done. The nation wide educational effect can not be overestimated. There are no scoffers and few skeptics. A sense of wonder at the things accomplished, linked with speculation concerning the possibilities of the future, has been experienced by layman and the telephone man alike. The transmission surprises have been such that no man today is bold enough to predict any probable limit. Impressive occasions in illustration have been so numerous that to register them specifically would make the story too long. Performances which a few months ago caused excited comment and wide publicity are now accepted as a matter of course. We recall the inauguration of Doctor Ray Lyman Wilbur as president of Leland Stanford University, when, following the formal ceremonies in the Memorial Chapel, Doctor Wilbur, in the presence of 200 members of the faculty and student body assembled in Stanford Union, delivered to the alumni in New York a ten-minute epitome of his powerful inaugural address outlining his theories of college administration. For the first time in history graduates thousands of miles away participated in the inauguration of a college president, listened to his address and congratulated him by telephone. The result, marvelous as it was, has since been wholly eclipsed by the demonstrations for the American Institute of Electrical Engineers, embracing six cities and 5,000 listeners, the telephone societies with four cities and 6,000 listeners, and finally the national meeting of 7,000 members and guests of the alumni associations of the Massachusetts Institute of Technology in thirty-five cities scattered over the United States, connected by 17,000 miles of pole line and 80,000 miles of wire. All previous notions of transmission were exploded that night.

Pioneers will remember Mr. Scott's address of welcome at the St. Francis in September, during which he dwelt upon the wonders already accomplished, and said that it would not surprise him to learn that "The Wizard Carty" had invaded the skies and talked with Mars. That "The Wizard Carty" had invaded the skies was soon revealed, but the rumor that a Martian wizard talked back is still unconfirmed. But the end is not yet. Probably some other big revelation is imminent. We await it with entire faith, nothing doubting. In this history-making epoch it is well to be a telephone man.

Mobilization of telephone facilities for the government, requiring but a small portion of our plant, left us with an abiding sense of security and preparedness for any eventuality. The country knows that the Bell companies are ready. Tribute has been accorded by all men. It is conceded that no other organization public or private, could have done these things so well or in fact could have done them at all. It has all been tremendously worth while.

The Constructive Analyst

Every field of industrial activity is calling for the man trained in the art of analytical thinking—the man who with calm deliberation logically separates the important from the non-essential and produces facts, not opinions; all the essential facts, not only the most obvious ones; new ideas, not old traditions. He is called an engineer, but he needs not engines with which to ply his art. Agriculture, law, medicine, salesmanship, business management, research of materials, design and construction of machines, organization of men, purchasing, accounting—all demand the analytical, unprejudiced, thorough man. Indeed, it is doubtful if men without this characteristic can advance beyond mere routine work.

The best known methods in nearly every walk of life are crude, clumsy and wasteful, and the whole world is looking to the constructive analyst to find better ways—short cuts in time and material—that life may be more abundant for all mankind. A young man about to enter industrial life should investigate, first of all, the various branches of the profession he has chosen. He should apply engineering methods in determining his life work and in fitting himself to it. Success to any considerable degree comes only to him who masters some subject with distinction. Be sure, however, that you find the best subject for you.

The important thing is to select your special work with such care that it will always be your chief pleasure; then failure, in whatever terms you choose to measure it, will be impossible. On the other hand, calmly to follow the chance demand, the advice of friends, or the lure of immediate wealth is dangerous to any success. There is nothing inherent in any worthy task that makes it less desirable, less respectable or less profitable, save the way in which it is performed.—C. R. Dooley in *The Electric Journal.*

Nebraska Has New Independent

There may be another telephone company with its central office in Kearney, Neb. The Union Valley Telephone Company requested a franchise allowing it to use the streets and alleys for its poles and wires and to establish a central office.

It is thought that the move came through the dissatisfaction of the members of the company over the proposed raise in the switching charge.

The Union Valley Company claims 174 farm subscribers. It asserts that it has other companies ready to associate with it and that the nucleus for the Kearney central would include more than 300 Buffalo county telephones.

W. D. Thornton is president of the company and George Bischel secretary and treasurer. Mr. Bischel presented the petition in person.

Company Liability for a Bungled Telegram

What Recourse Has the Addressee Against the Company, Where He Makes a Loss Through It?

BY ELTON J. BUCKLEY

HERE is a legal problem that many will be interested in:—

Pittsburgh, Pa.

Please tell us whether the telegraph company is liable for our loss in this case. We are handlers of the above California products, and we do considerable business with a house in Los Angeles, Cal. We communicate with them more by wire than we do by letter, usually by code. Not long ago the market in a certain Philadelphia product was on the verge of an advance and we wired asking for lowest price on two cars of futures.

Back came a code telegram telling of firm and advancing market and advising us to buy at $5.25 per bushel, which price we had told them was being offered by another house. Following the words advising us to buy at $5.25, they had added the following code words "we guarancante," meaning "we will not sell at this price." The telegraph company bungled the word, and made it "we guarantee," making us think that they too were willing to sell at $5.25 and were moreover guaranteeing this price against decline. Accordingly we wired out an order for two cars at $5.25. In due course the Los Angeles house advised us of our mistake, but by that time the market had advanced to $5.75. We had lost our chance to buy of the other house at $5.25, because of the telegraph company's mistake, and were compelled to pay $5.75, making a loss of $500 on two cars. Have we any recourse against the telegraph company?—Respectfully, J. T. & Co.

I believe you have, and while I am discussing this I can say some things which may be interesting about the law of liability in such cases.

Any suit against a telegraph company bristles with complications, because telegraph companies have worked all the ingenuity which was theirs, for years in order to relieve themselves from the consequences of their own negligence. These efforts have caused continual warfare between the companies and their customers, resulting in many court decisions, by no means uniform as between the different States. The courts have held them back all they could, some more than others.

On the back of every telegraph blank will be found the following, or a very close modification of it:

ALL TELEGRAMS TAKEN BY THIS COMPANY ARE SUBJECT TO THE FOLLOWING TERMS:

To guard against mistakes or delays, the sender of a telegram should order it repeated, that is, telegraphed back to the originating office for comparison. For this, one-half the unrepeated telegram rate is charged in addition. Unless otherwise indicated on its face, this is an unrepeated telegram and paid for as such, in consideration whereof it is agreed between the sender of the telegram and this Company as follows:—

1. The company shall not be liable for mistakes or delays in the transmission or delivery, or for non-delivery, of any unrepeated telegram, beyond the amount received for sending the same; nor for mistakes or delays in the transmission or delivery, or for non-delivery of any repeated telegram, beyond fifty times the sum received for sending the same, unless specially valued; nor in any case for delays arising from unavoidable interruption in the working of its lines; nor for errors in cipher or obscure telegrams.

2. In any event the company shall not be liable for damages for any mistakes or delays in the transmission or delivery, or for the non-delivery of this telegram, whether caused by the negligence of its servants or otherwise, beyond the sum of $50, at which amount this telegram is hereby valued, unless a greater value is stated in writing hereon at the time the telegram is offered to the company for transmission, and an additional sum paid or agreed to be paid based on such value equal to one-tenth of 1 per cent thereof.

3. The company is hereby made the agent of the sender, without liability, to forward this telegram over the lines of any other company when necessary to reach its destination.

4. Telegrams will be delivered free within one-half mile of the company's office in towns of 5,000 population or less, and within one mile of such office in other cities or towns. Beyond these limits the company does not undertake to make delivery, but will, without liability, at the sender's request, as his agent and at his expense, endeavor to contract for him for such delivery at a reasonable price.

5. No responsibility attaches to this company concerning telegrams until the same are accepted at one of its transmitting offices; and if a telegram is sent to such office by one of the company's messengers, he acts for that purpose as the agent of the sender.

6. The company will not be liable for damages or statutory penalties in any case where the claim is not presented in writing within sixty days after the telegram is filed with the company for transmission.

7. No employee of the company is authorized to vary the foregoing.

8. The above provisions shall be binding on the addressee of this message, as well as the sender.

This goes about as far as human language can to hold the company blameless for its faults, but happily the courts have held that considerable of it was against public policy and invalid.

The case submitted involves four main questions:—

1—As the contract to send this message was between the company and the sender, can the addressee, who had no contract with the company, sue the company for damages for violation of the contract?

2—If the wording on the back of the message is a good contract between the sender and the company, is it binding on the addressee?

3—What is the company's liability for errors in transmitting code messages? Is a code message a cipher message?

4—If the addressee can sue for damages, what damages can he get?

I assume that the sender of this message wrote it out first on the company's message blanks. If he wrote it on plain paper, neither he nor anybody else is bound by the stipulations on the back, even though the company's employee took his memorandum and copied, or attached it, to a blank bearing the stipulations.

Answering No. 1, the addressee can sue, practically in every state in the Union. Different state courts give different reasons for this attitude, but I need not go into them, as they all come to the same thing.

Answering No. 2, the law is not settled as to whether the addressee of a message is bound by the stipulations on the back. Obviously he shouldn't be, for he never agred to them and did not see them before the message was sent. Some states say that he is bound, others (including Pennsylvania, this correspondent's state) say he is not, for the reasons I have given above. Perhaps the majority opinion is that he is bound.

But the stipulations on the back are not always a good contract even with the sender. Some courts have held these stipulations to be reasonable, but even these courts will hold the company responsible for wilful misconduct or gross negligence. Other courts say all such efforts to dodge responsibility are against public policy and void where the company has been guilty of even ordinary negligence.

This also applies to the stipulation confirming the company's liability in damages to the amount paid for

the message, or to ten times that, or to $50—making any limitation of damages under full compensation.

Answering No. 3, a code or cipher message means, I take it, any combination of words which to a telegraph company would be meaningless. In a straight message like "Will sell for one hundred dollars," it is one thing for the company to make the mistake of saying "will not" for "will." In a code message like "orange lemon oscar prints funnel," it is quite another thing for the company to make it tunnel instead of funnel, of course completely changing the meaning. In many states an addressee cannot collect more than nominal damages when the message was such that the agent could not understand it and its meaning was not explained. But in some other states (a fewer number) the company will still be held responsible. But in all states the courts will examine all the facts and will hold the company responsible even on a code message, whenever they can. Where the message is obviously a business message, for instance, between a buyer and a seller, where prices are named in it, the company is put on notice, and even where some code words are used, many courts will hold the company responsible for plain negligence.

Where a message plainly said "guarancante" and the company wrote it guarantee, I believe almost any court would hold this to be negligence, because it was not especially obscure. Admittedly telegraph companies should not be held so strictly responsible for translating things they cannot understand, but there seems no reason why they should not have understood "guarancante."

Answering No. 4, the measure of damages, where damages can be obtained, is the real direct loss. In the case submitted, it would be the difference between the price at which the addressee could have bought, and the price which he finally had to pay.

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Training School for Telephone Employes

To prepare promising young men for supervisory positions and give them a working knowledge of various departments maintained in the telephone business, the Michigan State Telephone Company has organized a training school for special employes.

Fourteen graduates of six of the leading colleges and universities of the country have been selected through faculty recommendation to constitute the first class formed under this new plan. Of this number three are graduates of the University of Michigan, four are from Purdue, four from Clark University, one from each of the following: Butler college, University of Wisconsin and Penn State. The young men are treated as employes of the company from the time they enter the school, and come under its sickness benefit, old age pension and death benefit plan.

"The telephone business has grown wonderfully in all parts of the country in the last few years," says G. M. Welch, general manager. "This tremendous development has created a very wide field of opportunity for men wishing to enter a line of activity in which there is good prospects for realization of ambition to reach high station in the business world. Experienced men are in demand in every branch of the telephone business and because of the still greater expansion of the business is prospect for the future, the demand for experienced, capable employes, especially in supervisory positions, is likely to increase from year to year.

"The average telephone man of today is a specialist, trained in only one branch of the telephone business. Although many such specialists are required to conduct the work of each department, a certain number of all-around men are needed every year to fill supervisory positions. It is also advantageous, both to the employe and the company, to have every man who occupies a responsible position acquainted with at least the fundamental principles which under lie all branches of the work. With this end in view a number of special employes are to be taken on each year and given a systematic training in each of the various departments."

It is believed that this system of employment will especially appeal to the young man just leaving college, as not only will it give him a broad knowledge of the telephone business, but also will enable him to try his hand at each class of work and decide for himself what work he is best suited to do.

The plan is, as far as possible, to give the man an actual job in each department, the same as with other employes. It is not the intention that the special employe shall be a student or an apprentice, so-called, although his work will receive special supervision, and he will be given every possible opportunity to learn all he can about the work in which he is engaged.

The employe will be furnished the company's standard specifications, bulletins and other reading matter and will hold conferences with men in charge of the various departments. Special employment will last one year, divided approximately as follows: Plant department, three months; traffic department, three months; engineering department, two and one-half months; commercial department, two and one-half months; accounting department, one month. At the end of the course, the employe is placed in whatever department he is best suited for, his own preference being considered as far as possible.

The training school is operated under the direction of C. Kittredge, chief engineer. A general training will be given by means of talks and reading matter on such subjects as "Relation of the Company to the Public," "General Principles of Organization," "Relations Between the Various Departments." Lectures will be given by the heads of departments, who also will direct the reading. The aim will be to give the employe a general understanding of the complete department and the relation of its various parts. Such employes will be given regular work with other employes, but with such men as are especially selected on account of their ability to impart information regarding each part of the work.

Telephone Rates Conference Topic

Important questions applying to independent telephone toll service, such as the initial period, night rates and methods of rate computation in Pennsylvania, were considered at a meeting of the Eastern Pennsylvania Independent Telephone Association, Eastern Traffic Association and the Western Pennsylvania Independent Telephone Association at Harrisburg.

The service committee of the Eastern Pennsylvania Independent Association has reported that a new arrangement should be entered into with reference to the employment of a service and traffic engineer to bring about better results than at present exist, and this report will be given careful attention.

Put all your energy into your work; but all the same, save some for emergencies. Capital and surplus are two different funds.

Public Utility Commission News

Reports Cancerning the Activities of State Regulating Bodies in the Telephone Field

California

THE State Railroad Commission notified the Public Service Commission that the hearing on the proposed merger of the Pacific Telephone and Home Telephone companies of Los Angeles has been set for October 16 in the Union League building. Commissioners Thelen and Gordon will hear the case.

The city will oppose the merger. President Fulton Lane gives the following reason for this action:

"The franchise of the Sunset company expires November 16. At the last general municipal election a vote was taken which committed the council and the city to the policy of granting the Sunset company a new franchise on condition it should put in an interchange exchange so as to make it possible to call any subscriber in the city; that is, one could call from one system to the other. By doing that the people indicated they did not want the Sunset company to operate with the Home company's franchise, which it would do through this merger.

"We are opposing this merger because it means the American Telephone Company, the Bell system, will control the telephone system here and there will not be any competition existing, and it may be difficult to keep up the service the city is now getting, the service being about the best there is in the United States, owing to the keen competition between the two companies."

Illinois

Arthur Kneisel of Chicago, telephone engineer for the State Public Utilities commission, was in Kewanee, Ill., the week of September 15 to appraise the property of the Kewanee Home Telephone Company. The commission is appraising the local property and equipment with the view to deciding whether or not the investment here justifies the advance in rates, for which the telephone company has petitioned. It is announced that two other engineers will assist Mr. Kneisel with his work.

Indiana

Permission to purchase the Consolidated Telephone Company of Danville, Ind., by the Indianapolis Telephone Company is sought of the Public Service Commission in a petition filed by the two utilities. The authorization of a $78,000 bond issue to cover the purchase price also is asked by the Indianapolis company. The Consolidated company also wishes approval of a $50,000 bond issue if the transfer is authorized. The bonds are to bear 5 per cent and will be issued to cover the cost of improvements and extensions.

The Danville company has exchanges at Fayette, Pittsboro, Plainfield, Brownsburg, North Salem and Danville. The lines serve 1,640 patrons. There are said to be no incumbrances on the property. Many wires of the Danville company are on poles of the Indianapolis company. The stockholders of the selling concern do not wish to develop the business, which is said to be growing.

The commission heard the case of the Boswell Telephone Company and the Farmers' and Merchants' Co-operative Telephone Company. Residents of the town stated in a petition that the Boswell company operates telephone lines and a switchboard in the town and that the other company operates a system in the nearby country with an exchange just outside the corporate limits.

It set forth that because the Boswell company has refused to allow the Co-operative company to connect with its exchange the stockholders of the other company have boycotted the town and that a grave commercial situation has resulted. The citizens ask an order allowing them to connect their lines with the Co-operative company.

Iowa

Franchises to build power electric transmission lines along public highways which are also occupied by rural telephone lines are being granted by the state railway commission now with a reservation that if the service of the telephone line is interfered with, the commission may make a further order regarding this condition. The commission has been making such requirements of all companies to which it has granted franchises since the latter part of April.

Kansas

Three telephone orders were issued September 13 by the public utilities commission. The Chikaski Telephone Company was authorized to sell its exchange at Milan to E. J. Frantz. The Wilburton Telephone Company received permission to buy the Elkhart Telephone exchange from C. E. Gilmore. The commission also authorized the consolidation of the two exchanges at Valley Falls.

Missouri

The Home Telephone Company of Joplin has filed an application with the state public service commission for authority to purchase the Nevada Telephone Company exchange and the exchange of the Missouri & Kansas company at Nevada, the object being to consolidate the two.

Representatives of 800 telephone companies doing business in Missouri held a conference, September 19, with the state public service commission relative to the establishment of uniform rules for collections, contracts, and all accountings with the public. More than 150 men were present when the conference opened, some of them representing a number of companies. On the suggestion of the commission two committees were appointed, one on accounting and one on rules, with the understanding that these committees will meet in St. Louis about the first of October and formulate plans and submit the same to the commission for approval.

Montana

The state utilities commission promulgated a rule, which goes into effect October 1, relating to the length of conversations on rural telephone lines. Under the

rule no one can use a rural party line longer continuously than five minutes if the line is demanded by the exchange operator or by another party on the same line. The penalty for violation is the removal of the telephone.

In the same decision the commission also directs that the rate for switchboard service of the Mountain States Telephone & Telegraph Company on rural lines owned by companies or individuals apart from the owner of the switchboard service shall be 50 cents per month. The order does not affect rural systems that also use the push button system to call subscribers on the same line.

Oregon

Charges that the Pacific Telephone and Telegraph Company makes it embarrassing for delinquent subscribers, are contained in an informal complaint filed with the state public service commission by A. F. Flegel, Jr., a Portland attorney.

Frequently, Flegel asserts, the company refuses to permit incoming calls to reach the subscriber, telling applicants that the telephone has been disconnected. Outgoing calls, however, are permitted and the full toll charge is made against the subscriber even though he is able to use his instrument but one way.

On other occasions, it is declared, the company disconnects instruments but charges for the period between the time the bill is due until it is paid. Flegel asks relief from the commission on his own behalf and on that of others.

Ohio

The merger of the Central District (Bell) telephone with five other Independent phone companies in eastern Ohio was approved by the state utilities commission and a schedule of rates announced which the Bell company may charge in the various localities under the merger. The state board reduced the free service area and at the same time raised the rates in several localities. The merger involves the Central District (Bell) telephone, the Belmont (National), the Washington, the Jefferson, the Union and the Woodsfield telephone companies. The commission fixed the final total valuations of the combined telephones at these figures: Reproductive, $1,580,877.73; depreciation, $238,628; present value, $1,341,794.24. The Bell company wanted the present value placed at $1,405,129.

New rates ordered are:

Martins Ferry exchange—Local "free" service area includes Martins Ferry, Altenheim, (Pleasant Valley,) Bellaire, Bridgeport, Colerain, Rayland, Shadyside, Warwood, Wheeling and St. Clairsville; business, independent, $54; 2-party, $43; 4-party, $36; multi-party, $36; extension, $9; switch rate to farmers' line, $5; residence independent, $30; 2-party, $24; 4-party, $18; multi-party, $18; extension, $6; switch rate, $5.

Bridgeport exchange—Local "free" service area includes Bridgeport, Altenheim, (Pleasant Valley,) Bellaire, Colerain, Martins Ferry, Shadyside, Wheeling and St. Clairsville; business independent, $54; 2-party, $42; 4-party, $36; multi-party, $36; extension, $9; switch rate, $5; residence, independent, $30; 2-party, $24; 4-party, $18; multi-party, $18; extension, $6; switch rate, $5.

Bellaire exchange—Local "free" service area includes Bellaire, Altenheim, (Pleasant Valley,) Benwood, Bridgeport, Key, Martins Ferry, Shadyside, Wheeling, St. Clairsville; business rates, independent, $54; 2-party, $42; 4-party, $36; multi-party, $36; extension, $9; switch rate, $5; residence, independent, $30; 2-party, $24; 4-party, $18; multi-party, $18; extension, $6; switch rate, $5.

Shadyside exchange—Local "free" service area includes Shadyside, Altenheim, (Valley Grove,) Bellaire, Benwood, Bridgeport, Key, Martins Ferry and Wheeling; business, independent, $54; 2-party, $42; 4-party, $36; multi-party, $36; extension, $9; switch rate to farmers' lines, $5; residence, independent, $30; 2-party, $24; 4-party, $18; multi-party, $18; extension, $6; switch rate, $5.

The Ohio State Telephone Co., and the Central District Telegraph Co., (owned by the Bell company), asked the public utilities commission for authority to interchange service and to sell property to each other in Columbiana county. The former will sell its plants and exchanges in East Liverpool and Wellsville to the latter for $104,258, and the latter will sell its plant and exchange property at Salem, Lisbon, Columbiana, Leetonia, East Palestine and Salinville to the former for $139,719. The toll lines, central office equipment and subscribers' stations are not to be included.

Pennsylvania

Some of the reasons for the refusal of a majority of the Public Service Commission to approve the contract of the Keystone Telephone Company, of Philadelphia, for lease of some of its unused duct space in its conduits to the Philadelphia Electric Company were given out last month by Commissioner Magee. He took the position that the contract required too high a minimum after a certain number of years and that it all came from patrons, that no provision was made for burying the wires within a specified term and that there was no guarantee that much duct space would be used.

The Public Service Commission at its executive session took no action on the application of the Eastern Perry Telephone and Telegraph Company for the approval of the sale of the stock, franchises, property and good will to the Cumberland Telephone Company of Pennsylvania, continuing the case. The Commission heard arguments in a number of western freight cases on September 9.

Washington

Two hundred telephone users in and around Tacoma, who contracted with the old Independent Telephone Company before its merger with the Pacific Telephone and Telegraph Company, will be affected by a decision of the state public service commissioner, handed down at Seattle, which abrogates obsolete rates and authorizes an installation charge of $3.50. The decision provides for an increase of from 50 cents to $1 a month, bringing in $45,000 additional revenue yearly. The order will affect 7,000 telephone users, mostly in Seattle, but Manager Schlarb of the Tacoma company said some Tacoma rates will be affected. He said some rates there may be raised and others lowered.

When your fellow worker is fired, congratulate him; he now has the opportunity to go after one of those better jobs he feels capable of holding. It is easier to be pushed out of a rut than to jump out.

Telephone Patents Issued Recently

A Brief Digest of those Current Specifications Most Interesting to Telephone Men

BY DAVID S. HULFISH

NO. 1,191,152. Automatic Selector. Issued to A. M. Bullard, assignor to Western Electric Company, Inc., New York, N. Y. For reaching quickly an idle trunk and for passing quickly over a large number of intervening busy trunks, the selector steps over busy trunks at a group per step, and then trunk by trunk when a group containing an idle trunk is found.

1,191,210. Automatic Supervisory System. Issued to T. G. Martin, assignor to Automatic Electric Company, Chicago, Ill. Filed March 30, 1909. Four wires extend from the telephone to an automatic stepping switch; two of the wires are for speaking and two for stepping the automatic switch.

1,191,265. Automatic System. Issued to J. L. Wright, assignor to Western Electric Company, Inc., New York, N. Y. The automatic switches are rendered sensitive to control by sounds received over a telephone circuit.

1,191,917. Automatic Trunking and Supervisory System. Issued to Wilson L. Campbell, assignor to First Trust and Savings Bank, trustee, Chicago, Ill. Application filed February 26, 1907. In a special service directory number where several operators are required to give the service, several subscribers may call the same number and a key at each operator's position (except the last) will transfer the next call to the next operator.

1,191,940. Ground Clamp. Issued to William H. Blood, Jr., Wellesley, Mass. A flat plate has three holes, through the middle one of which a screw with nut is placed; the wire is taken a turn through each of the other holes, and the screw presses against the ground rod or grounded pipe to strain the wire to be clamped.

1,192,007. Manual System Switchboard. Issued to F. M. Slough, assignor to Garford Manufacturing Company, Elyria, Ohio. The supervisory relays of the calling plug connect the operator's circuit to the cord pair until the calling plug is inserted into a jack.

1,192,064. Selector for Party Line. Issued to J. A. Hulit, assignor to Automatic Electric Company, Chicago, Ill. A stepping device for the telephone station; impulses over one line advance the selecting ratchet and an impulse over the other line wire restores some switches but not others, until the selection is attained.

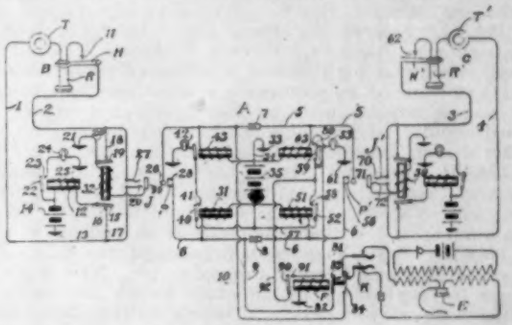
1,192,165. Call Distributing System. Issued to H. P. Clausen, assignor to Western Electric Company, Inc., New York, N. Y. A calling line is switched automatically to a waiting manual operator, but when the operator is busy the call is sent elsewhere.

1,192,175. Selector Switch. Issued to A. H. Dyson, assignor to Western Electric Company, Inc., New York, N. Y. In a selector switch for automatic exchanges, a series of brush sets are normally inoperative; one set is rendered active and then is moved over a series of sets of contact tags. The selection of the brush and the selection of the tags is accomplished by the rotation and lateral shift of a shaft carrying all of the brushes.

1,193,053. Automatic System. Issued to Lipa Polinkowsky, assignor to Western Electric Company, Inc., New York, N. Y. In an automatic system having call meters and having pilot switches or sequence switches, the sequence switch it restored from a meter-operating position in case of a successful call but from a non-meter-operating position in case of an unsuccessful call.

1,193,137. Meter Circuit. Issued to C. L. Goodrum, assignor to Western Electric Company, Inc., New York, N. Y. In the linefinder of an automatic exchange the calling line is detected by a special test wire which also is made to do duty as a meter wire for recording the call.

1,193,160. Automatic Trunking System. Issued to W. E. Lamb, assignor to Automatic Electric Company, Chicago, Ill. In a non-numerical switch for extending a subscriber's line to a



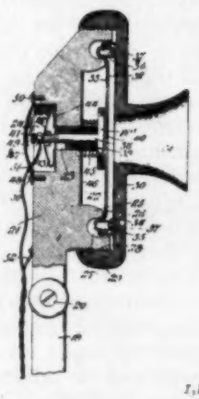
1,192,007.

connecting switch, the line is normally always in engagement with a trunk, which is taken if not busy when the telephone makes a call.

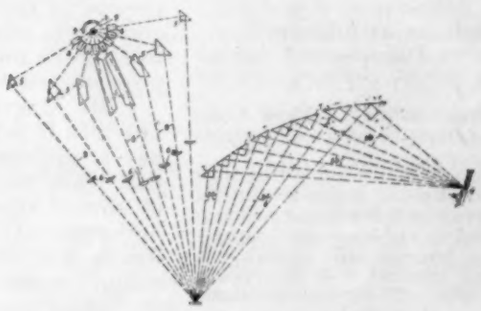
1,193,169. Metering System. Issued to T. G. Martin, assignor to Automatic Electric Company, Chicago, Ill. In an automatic system, the meter has its control from the current in the calling line, and the meter is operated by the action of lowering the current flowing in the line.

1,193,179. Telephone Call Register System. Issued to G. E. Mueller, assignor to Kellogg Switchboard & Supply Company, Chicago, Ill. Application filed November 19, 1906. The date of filing of application is very early and the claims are very broad. A telephone exchange system comprising telephone lines, selective switches automatically operated to select the calling lines, a call register individual to a telephone line, and mechanism for recording thereon against said line the number of calls originating thereover to which responses are secured.

1,191,940.



1,193,184.



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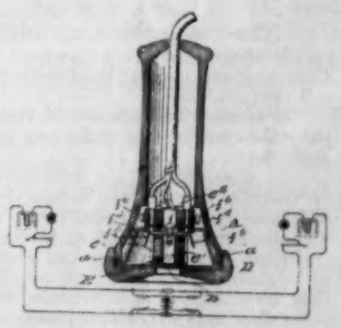


1,194,457.

1,193,184. Transmitter. Issued to A. Plecher, Las Animas, Colo. The diaphragm carries a conducting film upon its back surface, upon which film the back electrode presses.

1,193,458. Meter System. Issued to E. D. Fales, assignor to First Trust and Savings Bank, trustee, Chicago, Ill. Application filed December 8, 1906. The answering of the called subscriber closes the circuit of the meter of the calling line, operating through circuits of intermediate trunks and trunking switches.

1,193,999. Transmitter. From a source of light, beams are concentrated (by prisms and lenses) upon a sound-receiving diaphragm which reflects the beams through other prisms to selenium or equivalent devices which vary an electric current as the voice waves move the diaphragm.

1,194,280. Check Device. Issued to P. B. Delany, South Orange, N. J. A transmitter is placed under the writing pad and a message to be recorded, as a train order, is written upon the pad by dictation over the telephone line. The dictating officer hears the pencil recording the message, and is able to detect variations in the message.

1,194,339. Busy-Tone Circuit. Issued to T. G. Martin, assignor to First Trust and Savings Bank, trustee, Chicago, Ill. Application filed April 17, 1906. When a busy line is engaged, the connector is restored and then advanced to an intermediate position and a tone circuit is closed; the ringing generator is used a tone generator.

1,194,367. Linefinder System. Issued to B. G. Dunham, assignor to Western Electric Company, Inc., New York, N. Y. A starter wire selects an idle line finder and a calling line over that starter wire causes the finder to select first the group and then the line calling.

1,194,371. Selector for Party Line. Issued to John Erickson, assignor to Automatic Electric Company, Chicago, Ill. A stepping selector at each station is advanced by currents of one polarity; in some of its positions a selector may be released by a single reverse impulse, while in other positions it requires several reversed impulses and a single reversed impulse may be followed by other driving impulses until selection is made.

1,194,457. Receiver. Issued to B. D. Willis, assignor to Automatic Electric Company, Chicago, Ill. A receiver for direct current and so wound that the maximum inductance is reached with a current of less than one-tenth of an ampere.

1,194,851. Busy Test System. Issued to A. E. Lundell, assignor to Western Electric Company, Inc., New York, N. Y. Impulses for controlling an automatic switch are sent over the guarding wire of the switch, a strong battery being used for the controlling impulses and a weaker battery being connected to the wire at all times when busy for test or guarding purposes.

1,195,163. Ringing Circuit and Key. Issued to G. E. Wolf, assignor to Kellogg Switchboard & Supply Company, Chicago, Ill. An automatic ringing key rings intermittently upon a telephone line, but by the depression of a manual key the automatic ringing may be cut off and direct manual ringing may be applied to the called line.

Everett, Wash., May Have New Company

Delegates who attended a meeting at the Riverside in Everett, Wash., to discuss an increase in telephone rates made by the Puget Sound Telephone Company, adopted resolutions that immediate steps should be taken to organize an independent telephone company in an endeavor to secure better service at less cost.

The resolutions, as adopted, are as follows:

Whereas, Certain subscribers of the Puget Sound Telephone Company are not satisfied with the present telephone rates and toll charges, and

Whereas, The officers of the Puget Sound Telephone Company have refused to make any resolutions or offer any form of settlement;

Be it resolved, That it is the sense of this meeting that steps be taken to organize an independent telephone company with the object in view of securing better service at a lower cost and that a copy of this resolution be forwarded by the Riverside Commercial Club to each commercial club or representative organization throughout Snohomish and adjoining counties with the request that they appoint a committee to, first, call on each telephone subscriber in their vicinity and secure their pledge to join any new organization formed for the purposes above mentioned and, second, to secure a list of those willing to subscribe towards the purchase of stock in such organization and to what extent they will subscribe, the results to be reported at a meeting to be held at the Riverside Commercial club on Tuesday, October 3, at 8 p. m.

W. N. Winter, president of the Puget Sound Telephone Company, addressed the meeting, explaining his company's attitude. He said that the Independent and Sunset companies have been operating at a loss for a long time preceding the consolidation, and that the new rate charges were devised to get funds to pay bond interest. He said he was willing to have any accountant designated by those dissatisfied with the new rates go over the books of the company and to determine the amount of its earnings on the new rates.

He said that in Everett the total charges would not be greater than before the consolidation.

Electric Company Cannot Use Keystone Conduit

The Pennsylvania Public Service Commission, at Harrisburg, refused September 9 to sanction a contract between the Philadelphia Electric Company and the Keystone Telephone Company, under the terms of which the electric company was to have the use of the underground conduits of the telephone company, with the right, after twenty-one years, to purchase outright all the conduit space then in use.

The action of the commission is regarded generally as of the utmost importance.

Through Edward M. Cooke, its general manager, the telephone company registered its opinion of the failure of approval as unfair. The franchise of the telephone company, Mr. Cooke said, gave it power to lease its conduits.

The contract between the Philadelphia Electric Company and the Keystone Telephone Company was consummated February 10, 1915. The deal was for the use of the telephone conduits on the basis of an annual rental of four cents per duct foot used, with a provision for a graduated minimum rental which would reach $100,000 per annum within seven years. The contract was to run twenty-one years, the average rental amounting to $37,500 per year.

At the expiration of twenty-one years the electric company was to have the right to purchase all conduit space then in use, or, if it elected, to extend the lease for another fifteen years at an annual minimum rental of $125,000.

Some of the reasons why the Public Service Commission refused to approve the contract for lease of conduits of the Keystone Telephone Company by the Philadelphia Electric Company, were given out in a statement by William A. Magee, commissioner, speaking for a majority of the commission.

The main reasons are the heavy rental, with the possibility that little duct space may be used; that the consumers would ultimately pay the bill; that there is too high a minimum rental and that there should be provision for burying the wires.

Mr. Magee, in his statement, reviews the situation in which it is shown that the electric company was to pay a minimum rental of $100,000 from 1921 on, and that while the telephone company had 10,000,000 feet of unused space there was no certainty that it would be employed. The protest of the city is reviewed at length and the statement says the commissioners would not now attempt to get at the actual value of the leased property or make an estimate of a rate of just return. Conditions in other cities are not equivalent to these existing in Philadelphia, it is said.

Telegraph and Telephone Supplies for Guatemala

The president of Guatemala has authorized the expenditure of the sum of $25,571.41 American gold for supplies which the national telegraph and telephone department will order. The national treasury is authorized also to pay insurance and freight on this shipment to Puerto Barrios.

Modern Telephoning

Another big business organization, the Remington Typewriter Company, has placed itself among the enterprising, far-sighted firms which realize that efficient, courteous use of their telephones will help them in their relations with the public and in the conduct of business inside their organizations, says the *Telephone Review*.

The Remington company made an extensive study of its telephone equipment and the prevailing methods of making and receiving telephone calls throughout the organization. At the conclusion of this study, which was assisted by telephone men, Vice-President A. A. Forrest of the Remington company issued a list of instructions for the use of the telephone by Remington employes. These instructions read as follows:

In view of the fact that improved telephone service will greatly facilitate the commercial transactions of this company, it has been deemed advisable to establish a definite method of handling telephone calls, and you are respectfully requested to observe the following rules.

The Remington Typewriter Company prides itself on service rendered to the public. Let us, therefore, extend this policy and by observance of these rules render service to ourselves.

Outgoing Calls:—Call by number, instead of by name. If this is not done the work of the operator is greatly increased and it deprives others of immediate service. In calling a number say, for example, "Rector 4980," not "I want Rector 4980." Every additional word on the telephone takes time, and when multiplied by the number of extensions in our office, the waste may be excessive.

Hold your line until you are connected or until you receive a definite report from the operator, except in the case of long distance calls. This is a courtesy to the person called. Nothing is more aggravating than to be called and then have to await the convenience of the caller.

Please consider the value of *personal calls* before making them. They take up as much time as those for regular business and we therefore ask that all unnecessary personal calls be discontinued.

To attract the attention of the operator move the receiver hook up and down slowly; rapid and violent moving of the hook is hard on the ear of the operator.

Incoming Calls:—When your telephone rings, *answer it immediately.* This releases the operator for other service. When answering the telephone say, "Mr. —— speaking." This saves time.

When passing a telephone which is ringing and there is no one there to answer it, take up the receiver and say "—— Department (or Mr. ....'s desk); is there any message?"

Do not expect the operator to make appointments for you nor to do any other service than that for which she is actually employed, *i. e.*, to efficiently operate a switchboard.

Inside Calls:—Call by name.

Hold your line until you are connected or until you receive a definite report from the operator.

Do not engage the operator in conversation over the wire or at the switchboard during office hours.

Answer your telephone promptly.

Call by number.

Hold your line until you are connected.

That the foregoing rules are productive of excellent results is shown by the following letter, which the Remington people sent to the telephone company three weeks after the telephone instructions had been put into effect:

We wish to thank you for the data you furnished us in connection with our telephone service and inclose two copies of the instructions which have been issued to our employes. These have already improved our telephone service immensely.

The equipment of the Remington Typewriter Company in its New York office consists of a three-position switchboard, 23 lines, and 91 extensions, using 106,500 messages.

Loose Connections

The loose connection is the worst enemy telephone men must contend with, and yet how many of us are careless when finishing some job we have been working on, says James Stewart in *The Mouthpiece*, the house organ of the Consolidated Telephone Company. How we will pass over places in the circuit where there is a possibility of a loose connection being discovered, taking for granted that because we have found one case of trouble there cannot possible be any more. Then comes the same complaint, the same careless looking over of the line and instrument, or possibly we won't look them over at all, just take off the receiver, get the operator, have her ring and decide that the subscriber is a crank. The patron continues to complain and if the wire chief is on *his* job we are told to get the trouble or somebody else will. Then, of course, we find it, after having made several trips, cost ourselves so much extra labor and the company so much extra extra expense.

Loose connections show up in many ways: cutting out, noisy lines (often mistaken for grounds by men that test by listening in), can't be heard, can't hear, can't get exchange, and can't get subscriber, are all loose connection troubles. And how many such cases of trouble are reported as—tests O. K., came O. K., found no trouble, etc., just because a thorough inspection was not made the very first time; and even though the troubleman may have spent but ten minutes traveling from his last case of trouble until he calls and reports one of the above excuses, his findings are accepted by the test table operator or wire chief, without questioning the fact that a man can hardly inspect a receiver thoroughly in ten minutes, let alone an entire telephone circuit.

Loose—that word loose is a bad one all around for us. Loose tie wire, loose (or slack) wire (line was crossed, of course), loose bell gong, loose receiver shell, loose anything in fact, but the tightening up process was not thorough. A thread was stripped, had no tie wire, had no buffalo grips, anything for an excuse to *leave it till the next time*, and then we forget to take the necessary supplies or tools the next time, and forget to report it to the wire chief so he could decide whether it should be done at once, or make a note of it so that he could see that it was done later, and remove the responsibility from our shoulders.

When such conditions arise, be sure and report them to the man in charge, not only by telling him, but give him a note and keep a copy for our own information, marking the date and to whom we reported it; we have then removed the responsibility from our shoulders, placed it where it belongs and if we are taken to task, can prove that we have done our duty in so far as we were concerned.

Let us all be more thorough; let us see who will have the least number of repeaters from now on; let us not be loose, but tighten up in our methods of doing every duty, and I am sure we will find pleasure in doing what we felt was a burden before. If we happen to miss a case of trouble and another report comes back—*get it*—if it takes a whole day, because one case of trouble cleared permanently, even if it takes a whole day, is far better than fifty chances that it won't come back; but, don't take too many days, at one case per day, or some other questions will be asked.

County Ownership Proposed in Nebraska

A petition has been circulated in Antelope county, Nebraska, and it is said has enough signatures to make it binding upon the county board, asking the Board of Supervisors to submit to the voters of the county at the election this fall the question of taking over of the various telephone systems of the county. The petition is predicated on the statute providing for such proceedings. The law provides for the acquiring of existing systems by an agreement with the owners as to the price or by condemnation proceedings, money to pay for the same to be raised by a tax levy or in case the tax which can lawfully be levied is not sufficient, by the issue of bonds.

In the case of Antelope county it would involve the purchase of a number of systems. There is one company in Neligh operating the town system and another with headquarters in Neligh and substantially the same ownership operating the country lines and also the exchanges at Brunswick, Royal and Orchard and the country lines leading out from there. The Cedar Mutual owns the town system at Oakdale and its connecting country lines. The Clearwater Company, also a mutual, operates in Clearwater and vicinity. The Elgin Company, likewise a mutual, controls Elgin and vicinity. By a mutual agreement there is a free exchange of business at present between the patrons of the two Neligh companies and those of Clearwater and Elgin in this county and Ewing, Holt county. In addition to these companies owned and operated in the county there are companies at Ewing, Creighton, Walnut, Petersburg and Tilden having lines extending into Antelope county and with which the local companies have physical connections.

It is understood the petition had its inception in a meeting held some time ago in Blaine township.

Another Indiana Deal

L. C. Griffitts, owner of the Seymour Mutual Telephone Company, Seymour, Ind., and his associates have consummated a deal whereby they become the owners of the controlling stock of the Scottsburg and Scott county telephone systems. The property was purchased from Mark Storen and others who lived in Scottsburg and vicinity. The system covering the county includes about five hundred telephones, three hundred of which are in Scottsburg and two hundred in the rural districts. It is said that the property is in a bad state of repair but the new purchasers have already made plans to improve it so that it will be one of the most up-to-date systems in any county in Indiana having the population of Scott.

The improvements on the Scott county system will begin as soon as the details regarding the change of ownership have been worked out, it is stated, and the new owners believe that many new patrons will be subscribers within a short time after the modern system has been installed. Considerable money will be expended in repairs and improvements, it is stated. Mr. Griffitts is an experienced telephone man and will omit no improvement in Scott county that will bring the service up to the standard of systems elsewhere which he controls.

Repairs to put the toll lines in condition to withstand the winter, additions to take care of added business due to the opening of the Colville reservation and general betterments to the service, aggregating $26,760, are announced by C. E. Hickman, division commercial superintendent of the Pacific Telephone and Telegraph Company. Of the total amount $9,710 is for improvements and extensions in Spokane, Wash., by the Home Telephone and Telegraph Company.

San Diego Home Reorganized

A committee representing the first mortgage bondholders of the San Diego (Cal.) Home Telephone Company, and a majority of bondholders and stockholders of that concern have obtained the stock as well as the bond control of the company's interests. The entire plant was turned over to this committee September 20.

Plans have been perfected for the future development of the system. Enlargements are planned and considerable new money will be expended. It is declared that the Home Company will become more active in its competition with the Pacific Company than ever.

The deal was completed through the law offices of Sumner & May. Mr. Sumner was the organizer of the company many years ago, and recently acted as its president, severing his connection with the concern last March.

The bondholders' committee consists of Dr. F. R. Burnham, Horace G. Low and Frank C. Avery of San Diego, and M. P. Snyder and T. Arthur Thompson of Los Angeles.

This committee assumes control of the stock and bonds through the purchase of the interests of Horace B. Day and his associates. Day and his associates, including Roy E. Thompson and E. R. Thompson, retire. Day has served as president and treasurer of the company and Roy E. Thompson as vice president.

Mr. Day and his associates have held the controlling stock. The bondholders' protective committee was organized about ninety days ago. The majority of the bondholders came into the new organization. Day and his associates are said to have held $270,000 out of the $500,000 of stock in the underlying company, and additional stock in the operating company.

"The Home Telephone Company will continue as a San Diego enterprise," said Mr. Sumner. "Local bondholders were prominent in completing the negotiations. Further development of the concern is assured."

M. P. Snyder of Los Angeles, a member of the bondholders' committee, was for three full terms mayor of Los Angeles, serving his last term in 1905. He is president of the California Savings and Commercial Bank of Los Angeles. He is a member of the public service commission controlling the aqueduct and power departments of Los Angeles. He predicted a fine future for the Home Telephone Company.

T. Arthur Thompson of Los Angeles, another member of the committee, is a director of the Home Savings bank of Los Angeles. He has been connected with the workings of independent telephone companies for years.

Opens Office in Columbus

Automatic Electric Company, through its Central Ohio representative, Roy Owens, has established a sales office in the city of Columbus, quarters having been secured in the Columbus Savings and Trust building.

A permanent staff is located there, so that all business will be transacted promptly and adequately, leaving Mr. Owens free to cover his territory personally.

From the earliest days this company has paid very close attention to the Ohio field, and the widespread and successful development of automatic telephony in that region has made it advisable to take this step, which it is believed will make it possible to serve the company's patrons there even more efficiently than in the past.

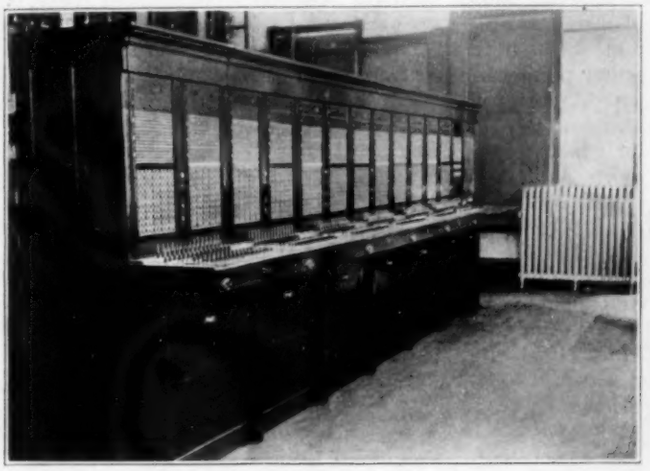
This arrangement will not affect the Toledo office, in charge of Seymour Hirsch and Frank H. Willand, who will continue to cover their present territory as before.

Of Interest to the Trade

What the Telephone and Accessory Manufacturers Are Doing to Advance the Art

Switchboard for Ashland Home Telephone Co.

The accompanying illustration shows the new central energy multiple switchboard recently put in operation by the Ashland Home Telephone Company, Ashland, Wis. This equipment was manufactured and installed by the Garford Manufacturing Company, now merged with the Stromberg-Carlson Telephone Manufacturing Company, and consists of 6 sections, 6 position, with 1,200 local lines, toll and rural lines installed with an ultimate capacity of 2,000 lines. This equipment represents the very latest and most rapid and efficient central office apparatus on the market. It is provided with automatic rapid service features, not only increasing efficiency, but decreasing number of operators. In addition to the main board there were supplied a combination toll board and chief operator's desk, wire chief's desk, frames, racks, terminal equipment and power plant, an installation that provides



The New Ashland Switchboard.

the city of Ashland with telephone service of the highest order. The enterprise shown by the Ashland Home Telephone Company in that respect will doubtless be appreciated in a substantial manner by the telephone-using public.

Automatic for Black River Company

Announcement has just been made by the Black River Telephone Company, which operates in the city of Lorain, Ohio, that it has decided upon a comprehensive plan of rehabilitation for its telephone system, involving the substitution of automatic central office and subscribers' equipment for its present manual switchboard, the erection of a thoroughly modern, fireproof building to house its executive and business offices and the Main exchange, and the addition of a new exchange to be known as the East office. The contract for the telephone equipment has been placed with Automatic Electric Company, of Chicago, and it is expected that the new system will be in operation early next spring.

The initial order for the central office apparatus provides for 1,800 lines, 600 of which will be for individual service, 100 lines for P. B. X's and 1,100 for party lines. The Main office will be equipped with 1,200 lines, the South office with 400 and the East office (new) 200 lines.

The central office equipment will be of the latest two-wire, common battery type with automatic ring and busy signal. The party-line telephones will be equipped with harmonic bells, giving full selective ringing, and reverting calls will be handled entirely automatically. The selecting switches will be of the horizontal relay, dust protected pattern, similar to those installed in St. Paul, Minneapolis, and Brainerd, Minnesota; Madison, South Dakota; Westerly, Rhode Island; Muskegon, Michigan, and Alliance and Washington Court House, Ohio, and ordered for Indianapolis and Harrisburg.

In addition the Black River Telephone Company will install a new six-position toll board manufactured by Automatic Electric Company and connected with the lines of both the Ohio State Telephone Company and the Central Union Telephone Company. Desks for the wire chief and the information and complaint clerks are also to be provided, all such service being handled at the Main office.

The Black River Telephone Company was organized twenty-two years ago, being the second independent company organized in Ohio. At that time the city had a population of 5,000 and the company served 100 patrons. Since 1894 the city has increased nine fold in inhabitants, while the telephone company has grown thirty-eight fold, having 3,850 telephones in service.

The Black River Company is locally owned and locally managed, its officers and directors being among the most prominent business men in Lorain. E. M. Pierce has been president since 1897, and is also treasurer and director of the Ohio Shovel Works. William Honecker, a leading druggist of the city, is vice president. The active management of the company is in the hands of C. V. Hageman, who is general manager and treasurer. The secretary, L. A. Fauver, has been with the company since 1902, and is also president of the Ohio Engineering Company.

On the board of directors are L. C. Alten, a hardware merchant; Hon. W. B. Thompson, judge of the Court of Common Pleas, and formerly attorney for the company, and B. G. Nichols, vice president of the Lorain Banking Company.

The slogan of Lorain, "Where Coal and Iron Meet," indicates the commercial and industrial importance of the city. Its growth, both in population and in manufacturing activity, has been very great, which has taxed the facilities of the telephone company to the utmost. With the carrying out of the program outlined above, however, the company will be in a position to cope with any demands which may be made upon it, not only at present, but in the future, and the officials look forward to a very substantial increase in the business it will be called upon to carry.

A Heavy Transaction

To avoid paying the Pacific Telephone and Telegraph Company rent on 180 telephone poles at 10 cents each, the state of Oregon has returned to the company a check for 17 cents, its share of the earnings for the last year of a telephone line from Big Eddy to The Dalles. Only one call was registered over the line.

Cook Company Announces New Arrester

The Frank B. Cook Company reports an unusually brisk inquiry regarding its new No. 5 multiple lightning arrester, illustrated herewith.

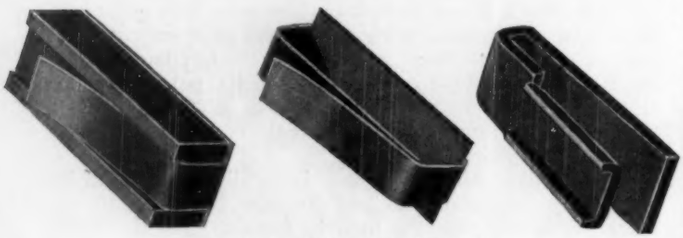
This lightning arrester is of 10-line capacity and is designed for either indoor or outdoor use. It can be quickly arranged for carbon or metal discharge surfaces. Consequently, it has a large field of service.

This lightning arrester consists of a heavy porcelain base mounted on a strong galvanized bracket and with a galvanized metal covering securely held by a spring, which is an exclusive Cook patented feature. The carbon blocks or metal discharge strips with their dielectrics are set up vertically, as illustrated, with ample air space underneath.

The connections on this new Cook No. 5 lightning arrester are very accessible, which makes it an unusually easy arrester to install.

The Frank B. Cook Company has also recently announced a new copper facing and a new phosphor bronze discharging clip. Both of these devices can be used on the new Cook No. 5 lightning arrester, as well as on any other lightning arresters of Cook manufacture.

By using these copper facing strips the same result is obtained as with solid copper blocks. These strips are



Frank B. Cook's New Arrester.

wrapped around grooved carbons so that the discharge surface is copper. It will be found much cheaper to replace old facings with new ones than to resurface and clean solid copper blocks when they are pitted and corroded. It is easy to install these strips and the same arrester can be quickly changed from carbon to copper or from copper to carbon.

The new Cook phosphor bronze discharge clip illustrated herewith will also be found a valuable acquisition in the telephone supply room. This clip performs the same function as a copper block or coper facing, but it is used without the carbon block. It also is simple, inexpensive and easily handled.

The Frank B. Cook Company, whose address is 326 West Madison street, Chicago, will be glad to furnish further information regarding any of these new devices.

Another Good Book

HOW TO LOCATE YOUR TELEPHONE TROUBLES, by J. Bernard Hecht, is just off the press. The author is a well-known engineer in the Northwest, having served eleven years with the Wisconsin Bell and eleven years as assistant chief engineer of the Tri-State Company, his present position. The work is of a purely practical nature, prepared for the beginner and the rural operator as well as the manager, wire chief and troubleman. Circuits and apparatus are clearly illustrated and described.

Published by E. C. Kast, 824 McKnight building, Minneapolis, Minn.; 68 pages, paper covered; price 75 cents.

Many Automatic Desks Installed

Two years ago the Pennsylvania Railroad equipped one of its freight houses in Pittsburgh with a small automatic telephone system. Although not regarded at the time as an "experiment," for the company was then convinced that the apparatus would meet its needs there, it has, nevertheless, served as a trial installation, and its operation has been watched closely.

That the Automatic has entirely met expectations is demonstrated most conclusively by the fact that during August the Pennsylvania Railroad has ordered two more Automatic exchanges, one of 100 lines capacity with 50 equipped, for Freeport, and the other of 200 lines, 150 equipped, for the Pitcairn yards and shops.

E. W. Zimmerman, division operator, and his assistant, Mr. Bright, have been particularly active in studying the telephone needs of the Pittsburgh division, and their very careful investigation of the Automatic has convinced them that this apparatus is precisely what is needed to secure the economical and efficient handling of the telephone traffic.

Pitcairn is one of the important points on the Pittsburgh division, being the site of large distributing yards and repair shops, and the Automatic equipment there is designed not only to handle the intercommunicating calls, but through trunks will connect this system to various other points on their lines.

Among other Pennsylvania companies to adopt the Automatic last month are the Philadelphia Tapestry Mills, of Philadelphia, which has contracted for a 50-line board, with 24 stations equipped at present, while the Carbon Steel Company of Pittsburgh has ordered a similar board with 32 telephones in service.

Two New York City firms, Hallgarten & Company, bankers and brokers, and Frank Seaman, Inc., advertising agents, have also ordered private Automatic exchanges to meet the intercommunicating needs in their offices. Another Eastern concern, the Union Manufacturing Company, of New Britain, Conn., has decided to equip its works with a 50-line board. Interesting because of its contrast with the above is the order received last month for a 50-line installation for the residence of James Deering, at Miami, Fla.

Seven Ohio companies contracted for Automatic private service during August, these being the Pattison Supply Company and the Grasselli Chemical Company of Cleveland, the Hostr-Columbus Company and the J. P. Gordon Company, of Columbus; the National Cash Register Company and the Dayton Engineering Laboratories of Dayton, and the General Fireproofing Company of Youngstown. All of the above installations will serve the intercommunicating needs of these organizations and will also operate in conjunction with the public telephone systems operated by the Ohio State Telephone Company in the various cities.

Turning to the west, the Overland Motor Company, of Chicago, has ordered a 50-line installation for its sales office and service station; the Edgar Zinc Company, of Cherryvale, Kans., is equipping its properties with Automatic service, and the Pierce-Fordyce Oil Association of Dallas, Texas, has taken a similar step.

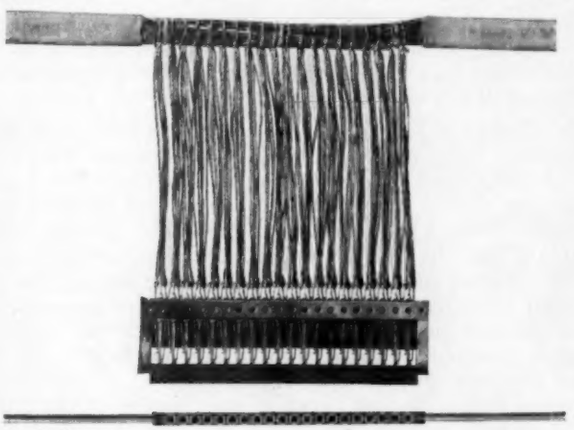
Going still farther west, to Australia, an order from the federal government there is recorded. This equipment, of 150 lines, will be installed at the Cockatoo Island Docks, in Sydney Harbor. The Australian Navy Yards is located there, a large work capable of turning out warships of the larger size, and a point of great importance at present.

In connection with the orders for P. A. X.'s received during August, it may be interesting to point out the diverse types of concerns which have placed them. Among these are bankers, railroads, mines, chemical works, specialty manufacturers, fabricators of iron, steel and textiles, and a private estate. Many and varied are the telephone needs of these different interests, but they all are well served by the automatic system.

Special Equipment for Ohio Exchange

The new Park Office exchange of the Ohio State Telephone Company, which will be installed at Toledo, Ohio, will be equipped by Kellogg Switchboard & Supply Company with No. 239 multiple jacks, which are mounted on ⅜-inch centers. The short multiple and long cables for this work are of special construction. The jacks are ⅜-inch thick and the cable is ¼-inch thick.

The cable is flat, as will be noticed from the photographic illustrations herewith, and is made in two sections so that it is possible by combining two cables under one braiding to obtain the proper dimensions. The difference in the dimension between the thickness of the jacks and the cable is to compensate for the piling of the multiple



Top and Front Views of Kellogg No. 239 Multiple Jacks.

cable as the height of the multiple increases. Where the short multiple cables join at one strip of jacks, special precaution is taken by making three ties, one at each end and one in the middle of the form. This is to enable keeping the cables in position at this point and also to compensate for the possible sag that occurs when cables are piled one on top of the other with the braid removed.

This cable produced in this form is an interesting and exceedingly efficient piece of work. The cable is saturated throughout its entire length. An elaborate iron cable rack system is to be installed in conjunction with this exchange, supporting the cables from the switchboard to the various distributing frames and relay rack.

When this cable is in place, it presents a very fine appearance. The Park Exchange, where this apparatus is to be, will be the largest modern telephone exchange in the United States, because, although there are other exchanges larger, there is none which is equipped with modern arrangements to be found in this switchboard. The culmination of the three past years' rapid development in manual switchboards will be evidenced in this installation.

Everybody in the Kellogg organization is exerting himself to make this the banner job in the history of the Kellogg Company.

Kellogg at the Indiana Convention

At the tenth annual Indiana convention, held at the Claypool Hotel, Indianapolis, September 14 and 15, the Kellogg Switchboard and Supply Company held a very interesting exhibition, displaying its latest apparatus, including the new low key shelf type magneto switchboard and P. B. X. equipment, which is proving very popular.

A. J. Carter, general sales manager; B. H. Blake and J. A. Campbell, sales representatives of the Kellogg Company, were hosts to many interested telephone men. Kellogg Bakelite receivers, keys and other Kellogg telephone and switchboard advantages were demonstrated.

The guests at the banquet found at each plate an attractive folder of deckle edge paper, containing the convention announcement and names of the officers of the association, the center pages having the words of "America."

Each guest was given a souvenir, the ladies being presented with a gold-plated brooch and the gentlemen with a bronze medallion, in the center of each being an embossed outline of the well known desk stand.

A school of instruction in operating was conducted by W. S. Vivian, secretary of the United States Independent Telephone Association, his lectures being illustrated by slides showing the various types of exchanges and their operating requirements, which were furnished by the Kellogg Company.

The switchboards used in the operators' school work were given to the Independent Telephone Association by the Kellogg Company and have proved a marked success in many years' service.

Good Switchboard Business

The Stromberg-Carlson Company reports that business continues excellent and that the demand for its different types of local battery switchboards is exceptionally active. During the past few days orders for such equipment have come from People's Co-Operative Telephone Company, Little Rock, Washington; Mackay Telephone Company, Mackay, Idaho; Cove Telephone Company, Cove, Arkansas; Kiowa Telephone Company, Kiowa, Oklahoma; Burlington Telephone Company, Burlington, New York; Oliver Telephone Company, Hensler, North Dakota; United Telephone Company, St. Mary's, West Virginia; Blair Telephone Company, Blair, Nebraska; Dundee Telephone Company, Dundee, New York; Renville Telephone Company, Donnybrook, New York; Garrison Mutual Telephone Company, Garrison, Iowa; Farmers' Co-Operative Telephone Company, Maxwell, Nebraska. These boards are of various capacities and completely cover local battery central office equipment. In the Stromberg-Carlson Bulletin No. 1012 complete description and illustrations are given. Copy will be mailed to interested parties on request to the company.

Letting Margaret Do It

When the Piedmont Telephone & Telegraph Company of Gastonia, North Carolina, wanted to get the idea of rural telephone service across, it decided to let somebody else do it. It succeeded and in a measure that far exceeded its own expectations.

To the students of the Gaston county high schools the telephone company announced an essay contest on the subject, "Rural Telephone Service." For the three best essays prizes in gold, amounting to $17.50 each, were to be awarded.

The contest was given great publicity. To help the

students in their quest for information the telephone company secured publicity material from the Western Electric Company and distributed it among the pupils in the various schools.

The young contestants solicited the aid of their teachers and parents in an endeavor to learn "reasons why" for rural telephone service—and all the time the Piedmont telephone was getting valuable publicity.

Rivalry was stirred up between the schools and the entire community was enthusiastic over the contest. The judges had difficulty in awarding the prizes, but the winners, contestants, and the public were all satisfied with the decisions.

The telephone company did not let the contest rest with its close. The *Gastonian*, a local paper, printed the winning essay, which was written by a girl, Margaret Parham, and gave prominence to both it and the contest. R. B. Babington, general manager of the telephone company, had the story as it appeared in the newspaper reprinted and distributed to subscribers and non-subscribers alike. The effect was more than satisfactory.

The contest and its results have proven a success on which the telephone company is cashing in every day. What the Piedmont Company has done, every telephone operating in rural communities can do. It pays to let Margaret do it.

Occurrence and Utilization of Zinc

A recent Bulletin of the Imperial Institute refers to the occurrence of zinc ores. The most important deposits are situated in Southern Corinthia, Styria and the Tyrol. In Bulgaria zinc ore has been raised from a mine six miles southwest of Vratza. In France the most important mines are those of Malines (Gard), Pierreflitte Bulard de Sentein St. Lang, Planioles, Bleymard and Bormettes. The production of zinc was commenced about 1870, and was then mostly carbonate, from the Alps or Pyrennes. At Malines the ores occur in a deposit of the middle Jurassic period. The output from the French mines in 1912 was about 43,000 tons in all. Germany ranks as second only to the United States as a producer of zinc ores, her most important deposits occurring in Upper Silesia, while smaller quantities are obtained from Rhineland, Westphalia, Nassau and the Hartz. Greece has her most important mines in the Laurium district. In Italy the most important mines occur in Sardinia, others in Lombardy, Piedmont and Tuscany; they are amongst the most productive in Europe. In Norway zinc ore has been mined at Hadeland, Moduin and Ranen, besides low-grade ores near Christiania. The most important deposits in Russia are those of Poland, the chief mines being near Olkusch. Near Bolishaw the deposits form a mass 2,000 feet in diameter and 50 feet thick. Rich deposits also occur in the Caucasus. In Spain 80 per cent of the output comes from mines in the provinces of Murcia and Santander. China has mines in the Human Province which in 1914 produced 22,875 tons of zinc ore concentrates. Zinc also occurs in Indo-China, the total output being 36,400 tons of ore. The Japanese mines have turned out 10,000 tons of crude ore, irrespective of minor quantities from smaller mines, most of the ore being obtained from the Kamioka mines. In Siberia it has been estimated that ore reserves amounting to 2,000,000 tons have been developed, particularly in the Ridder mine, Altai Mountains. This mine has been taken over by the Irtysh Corporation, which is building both lead and zinc smelteries at Ekibastus. Little information is available about Turkey in Asia, but the chief source appears to be Karsasu, on the Black Sea. Zinc ores are worked in Algeria in the Constantine Department, and numerous deposits occur in Sonk-Ahras and Tébessa. Tunis has an annual output of about 30,000 tons; these come from concessions about 25 miles from Beja, north of the Sidi-Ahmet Mountains. Several other localities have deposits of zinc ores. In America the United States holds the premier position as producer of zinc ore and spelter, there being important mines in about 13 different states. Missouri, Wisconsin, Kansas and Oklahoma are responsible for about 11,000,000 short tons (2,000 lbs.) in 1913, and accounting for over 50 per cent of the total spelter produced in the world. The following are the quantities of spelter produced in 1913 in the chief countries:

	Metric Tons.
United States	320,283
Germany	283,113
Belgium	197,703
United Kingdom	59,146
France and Spain	71,023
Russia	7,610
Norway	9,287
Australia	3,724

And the world's consumption of spelter in 1913 was 1,012,700 metric tons. In Belgium, since 1856, the production has been insignificant, but a considerable amount of ore is smelted there.

Probably the most successful electric method of smelting zinc ore is the De Laval process, which has been employed in Sweden. In this case the roasted ores are mixed with coal and a flux and smelted in an arc furnace. The product contains zinc, lead and other metals, and has to be refined by distillation. About half the cost of smelting is for electric energy, so that cheap electric power is essential for the process. In the Snyder process, as applied to zinc-lead ores, the ore is roasted to oxide and fluxes are added, so that the mixture will melt at about 1,000°C. This is then treated in an electric furnace, and results in the collection of lead, which falls below the slag and zinc oxide, which volatilizes and is condensed in brick chambers. Electric smelting of zinc has not come into general use. Regarding the commercial spelter, the chief impurities are lead, iron, cadmium and arsenic. If the spelter is used for galvanizing, lead causes it to peel badly, and if over 7 per cent, it causes brass castings to crack. Iron renders spelter hard and brittle, and cadmium is objectionable, as in brass it acts like lead. Arsenic is only objectionable when the spelter is being used to form hydrogen for use in lead burning, in which case it is impossible when arsenic is present to burn a strong seam. Regarding the uses of zinc, there is, of course, galvanizing, and the process called "sherardizing." In the latter case volatile zinc enters into combination with the iron surface, giving a protective coating. Another use is in the desilverization of lead, chiefly by the Parkes process. Finally it is used to extract gold by the cyanide process. Here 5 oz. to 1 lb. of zinc is used for each ounce of gold recovered. In South Africa the consumption of zinc for this purpose amounted to 4,867 tons in 1914. Zinc pigments, of which the most widely used are zinc white and lithopone, others being of less importance. Lithopone is used as a pigment and filler for rubber goods. It is a mixture of barium and zinc sulphates, with 0.5 to 1 per cent of magnesia. In the United States 29,685 short tons (2,000 lbs.) of this material were produced in 1913.

Anecdote of W. R. Patterson

Referring to the death of W. R. Patterson, which occurred in Chicago recently, B. E. Sunny, president of the Central Group of Bell telephone companies, briefly reviewed his career and related an anecdote in which appears a humorous side of Mr. Patterson's character, and one which was familiar to a few of his friends only. Mr. Sunny said:

"The various telephone publications refer to the death of W. R. Patterson, for many years connected with the Western Electric Company, and his invaluable work in the development of telephone cables.

"When the telephone industry was young, the difficulties encountered in the design and manufacture of cable were many, and, it seemed at the time, insurmountable. It was through his work that the lead-covered cable was developed, and he is, no doubt, entitled to all the credit for the perfection in the operation of that part of the telephone equipment. But Mr. Patterson's work was not only with cables for carrying telephone wires. He had an important part in solving the problem of a cable for carrying high tension electric light wires in the early days of electric arc lighting in Chicago.

"About 1888 most of the cables used in Chicago burned out frequently through short circuits between the conductor and the lead sheathing. The service was, therefore, very unreliable, and the electric light companies were meeting with heavy losses. The supposed experts in such matters decided that the thickness of insulation was more than sufficient, and also the quality of insulation used was satisfactory; still the cables burned out. By the simple process of thickening the wall of insulation, Mr. Patterson supplied a cable which did the work satisfactorily in every respect. The specification on which his cable was manufactured almost thirty years ago is still standard for that kind of work.

"Most people who know Mr. Patterson regarded him as a serious man, who devoted all of his time and thought to his work, and had no pastimes whatever. He did, however, have a saving grace of humor which manifested itself occasionally. A story is told of him that he went to his home one hot Saturday afternoon when his family were away and the house vacant, and got into the bathtub. While he was enjoying himself the doorbell rang. He paid no attention to it for a time, but it kept on ringing. It was evident that the person pushing the button meant to be answered, so that finally Mr. Patterson put on a bathrobe and went down to the front door and found a telegraph messenger with a message addressed to him. The message read:

> Have you bought your fall clothes? We invite you to see our fine stock.
>
> (Signed) J. A. HUSTLE.

"About two o'clock the next morning Mr. Patterson put in a call on the long-distance for Mr. Hustle at Oconomowoc, where he was spending the summer. The operator reported that no reply could be secured from that telephone, but Mr. Patterson urged that the matter was of the gravest importance and she must try again. Finally, a maid answered in Mr. Hustle's residence, and said that Mr. Hustle was asleep and could not be disturbed. Mr. Patterson again urged that the case was of extreme importance; that he had received a telegram from Mr. Hustle, asking for information that Mr. Hustle was very anxious to have, no doubt, at the earliest moment, and that he must be brought to the telephone. Finally, a heavy voice was heard in the telephone, but with Mr. Patterson's accustomed thoroughness, and knowing that Mr. Hustle had two sons, he cross-questioned the person at the other end as to whether it was J. A. Hustle himself. He was assured that it was. Then Mr. Patterson very deliberately explained that he had received his message, and was sorry for the few hours delay in replying, but he wanted to say to Mr. Hustle that he *had* bought his winter clothing!"

Interference

The interference between power circuits and telephone circuits, unfortunately, is all in one direction, since the telephone circuits have such a tiny amount of power they cannot in any way interfere with the power circuit, said E. E. F. Creighton in a discussion of certain papers read before the A. I. E. E.

These are two big public service interests in which we are all interested and which we want to see successful, and this problem is not one for the lawyers, but one for the engineers. If the engineers cannot get together and decide what can be done to minimize the effects of interference, the law court is a poor place to go, and the spirit which has been manifested on the two sides of this particular case—I was able to see it because I was brought in as a third party in the discussion of the value of the arcing ground suppressor in avoiding interference—gives hope that this interference may be eliminated in the future. There were cases of interference where the telephone girls received very bad shocks from the heavy grounds that were induced in the telephone line, and we were looking for some method of avoiding them.

The greatest cause of interference and the widest spread of interference between power lines and telphone lines is due to electromagnetic induction. Electrostatic induction is very bad in the case of a telephone line being near the power line, for example, if it is placed underneath or on the same pole with the power circuit. However, by placing the telephone line on adjacent right of way, the electrostatic troubles are reduced to a negligible value which the telephone company can take care of without trouble. When, however, we take into account the electromagnetic troubles, it becomes almost impossible to prevent interference. Take the one case of the Public Service Electric Company where the grounding current for the total system is only 60 amperes. The radius or distance which 60 amperes will influence the parallel telephone lines over is rather small. By grounding the neutral, however, that 60 amperes is turned into several thousand amperes, and the distance over which the electromagnetic force will influence the telephone lines is greatly increased.

One of the strongest factors in maintaining a non-grounded neutral system is by the use of the arcing ground suppressor.

Telephone Probe Boon to Wounded

The quick recovery of British wounded in the present war has been facilitated, according to army surgeons, by the invention of the telephone probe, an instrument which locates the presence of bullets or pieces of shrapnel in wounds by establishing an electric contact with the metal and giving an audible noise.

Brevities of the Business

The Activities of the Whole Telephone Field Told in Short Paragraphs

PERSONAL ITEMS

Einar A. Brofos, electrical engineer for the Western Electric Company, Ltd., London, Bell Telephone Mfg. Company, Antwerp, and the Western Electric Company, New York, paid a visit at the office of TELEPHONE ENGINEER.

L. B. Ness was recently elected treasurer of the Edinburg and Gardar Telephone Company, North Dakota, filling the vacancy caused by the resignation of Clarence Jaglum.

E. J. Howells, district manager of the Central Union Telephone Company at Jacksonville, Illinois, on September 1, assumed the same duties at Kankakee. Mr. Howells was succeeded by A. L. Taylor, formerly plant chief.

George B. Bastian of Rochester, New York, assistant supervisor of telephone lines in the service of the United States government, has been put in charge of a branch office opened at Freeport, Long Island, for the fourth inspection district of the Coast Guard.

O. P. Shurtz, commercial manager of the Boone County Telephone Company, Iowa, has resigned.

A. J. Beverlin, district manager at Rock Island for the Central Union Telephone Company, has been appointed assistant to C. H. Rottger, general manager of the company.

J. E. Reed, who has been connected with the Chicago Telephone Company in Gary, Indiana, for the past three years, has resigned to take a position in the electrical department of the Western Electric Company in Chicago.

J. E. Boyle, engineer, and M. J. Clarke, right-of-way man for the Bell Telephone Company of Scranton, Pa., had a narrow escape from serious injury when an automobile in which they were riding turned turtle after it had ran down a slight incline near Analomink, pinning the occupants underneath. Mr. Boyle is suffering considerably from shock and also sustained cuts and bruises of the body. Mr. Clarke suffered cuts and bruises of the right arm and leg.

Leslie Martin, lineman for the Federal Telephone Company in Le Roy, New York, has accepted a position as wire chief for the same company in Batavia. Gordon Cuyler of Atlanta succeeds him in the Le Roy office.

D. R. Campbell of Paragould, Arkansas, has assumed charge as manager of the Searcy office of the Southwestern Telephone Company, succeeding John W. Carter, transferred to Warren.

Henry Schmid, solicitor for the Bell Telephone Company in Allentown, Pa., has been promoted to assistant district traffic superintendent under E. A. McDonough. Mr. McDonough will continue as superintendent for a short time when it is understood Mr. Schmid will have the entire territory, which extends from Norristown to Shamokin and from Lebanon to Allentown and Shenandoah. Mr. McDonough will be transferred to a higher position.

John O. Beam, manager for the Bell Telephone Company of Pennsylvania in Reading, has been transferred to the Harrisburg office, where he will do special work. Roy Smith of Lancaster succeeds Mr. Beam.

NEWS FROM THE FIELD.

ALABAMA.

Notice of the incorporation of the Pickens County Telephone Company has been received by the Secretary of State. The company will have headquarters at Carrollton and will operate a telephone line in Pickens county. It has an authorized capital stock of $5,000 and will begin business with $1,400 paid in. Incorporators are M. I. Harper, Ben I. Rapport, J. M. Stapp, R. E. Elliott and H. M. Elliott.

The Southern Bell Telephone Company has installed a pay station telephone at the end of the Edgewood street car line in Birmingham.

ARKANSAS.

The farmers of La Rue and Mundell, east of Rogers, are building an independent rural telephone line.

The South Arkansas Telephone Company of Warren has filed articles of incorporation. The incorporators are: H. Thame, D. A. Gates, W. J. Savage, and W. J. Camp. Capital stock, $15,000, with $8,000 paid in.

CALIFORNIA.

The telephone company is installing a new toll line between Bakersfield and Fresno.

Word has been received at the Fresno telephone office that an appropriation of $16,440 had been allowed for the installation of a new toll board for handling long distance calls.

COLORADO.

The extension of the lines of the El Paso County Mutual Telephone Company through eastern El Paso county will be started in a very short time according to W. E. McClung, vice-president of the company. The work will cost about $5,000. The new lines will extend 16 miles east through the Chico Basin to Walker's camp, 14 miles south to Truckton and 15 miles from Walker's camp east into Lincoln county. Farmers will run their own laterals in the thickly populated sections.

ILLINOIS.

At a meeting held recently in Savanna it was reported prospects for a merger of the Mutual Telephone Companies and the Independent Company in the towns of Mt. Carroll, Savanna and Thomson were brought to a closer culmination. If the deal is put through there will be but one telephone company and line in the towns above named.

The South Chicago exchange of the Chicago Telephone Company, located at Eighty-ninth street and Muskegon, is progressing rapidly.

INDIANA.

The Home Telephone Company of Elkhart county has placed a booth in the corridor of the court house for the accommodation of the general public. This action was made very necessary through the toll charge now being exacted on Goshen-Elkhart calls.

Barnard Telephone Company, Barnard; capital, $950; telephone company; directors, H. A. Moreland, Charles Russell, Elmer Newby.

Hart F. Farwell, of Terre Haute, was re-elected president of the Indiana Independent Telephone Association at the close of the tenth annual convention, September 15, at the Claypool hotel, Indianapolis. Frank E. Bohn, of Ft. Wayne, was re-elected secretary-treasurer of the organization. The directors elected are: William Fortune, Indianapolis; Walter J. Uhl, Logansport; Samuel Tomlinson, Plymouth; F. R. Strickler, Franklin; S. M. Isom, Mitchell; F. R. Parrett, Princeton; J. A. Brown, Winchester; William Daily, Richmond; W. A. Harbrough, Sullivan; E. E. Dacey, South Bend; W. R. Nebo, Tipton; W. A. Stoops, Nappanee; T. E. Neal, Brookston.

IOWA.

A deal was closed recently for the sale of the Allerton Telephone exchange to Lon Dunn, of Milo. Possession was given September 1.

The telephone service in and near Silver City will be improved.

At a recent meeting of the board of directors of the Eureka Telephone Company, Osage, it was decided to sell the system to the Bell Company, though the sale must be ratified by the stockholders before it becomes effective.

The additional stories being added to the Merchants' National Bank in Eagle Grove will be occupied by the Iowa Telephone Company as a rest room for the operators and also as a storeroom.

Work on the additions to the Corn Belt Telephone Company's building in Waterloo has been started.

MASSACHUSETTS.

A building permit has been issued to the New England Telephone and Telegraph Company for the excavation for their new addition to the exchange at Worthington and Dwight streets, Springfield. Plans for the addition have not been completed. It is stated, however, that the addition will be five stories high, 82 feet wide and 107 feet deep.

MICHIGAN.

The Citizens Telephone Company has begun laying conduits through Wyoming Park, preparatory to putting all its wires in the little bungalow city on the Holland interurban, under ground.

Directors were elected at the annual meeting of the Citizens Telephone Company in Grand Rapids as follows: Robert D. Graham, Cyrus E. Perkins, Percival B. Garvey, John B. Martin, Gaius W. Perkins, William J. Clark, Willard K. Spencer, Frank E. Church, Charles E. Tarte, Van A. Wallin, Victor M. Tuthill and Walter Winchester.

MINNESOTA.

Alvarado will soon have day and night telephone service. The central office is nearing completion.

A new rural line to Ogilvie has just been added to the local service. No. 39 is a branch of the West Fish Lake Telephone Company and accommodates the following: G. Arbo, P. Toussaint, H. Gilbertson, E. Johnson, O. Amundsen, Mr. Monk, Jacob Lee and D. Dykstra.

The Rochester Telephone Company, owned principally by Mr. Melone of the firm of Melone & Stevenson, state agents of the Northwestern Mutual Life Insurance Company, has been sold to E. W. Randall and others of St. Paul, who will soon take over the plant.

The Tri-State telephone crew is stretching the wires on the Moose Lake-Brainerd line. The line will be completed the latter part of the month.

The Mantorville telephone system will be improved.

The Minnesota-Iowa Telephone Company, with headquarters at Mankato, has been incorporated with $50,000 capital stock. The company is authorized to establish and acquire telephone exchanges in Minnesota and Iowa. Incorporators and officials, all residing in Mankato, are: Halbert Merrifield, president; E. K. Ilgenfritz, vice-president and treasurer, and George E. Conrod, secretary.

MISSOURI.

The organization of a company to take over and operate the telephone systems connecting Branson, Forsyth and Hollister was tentatively outlined at a meeting of business men from the three towns at Branson. A committee of three representatives of each town was named to investigate the proposition.

The two telephone systems in Nevada will merge with the consent of the Public Service Commission.

The Audrain County Mutual Telephone Company, at its meeting held in Mexico, elected the following directors: S. P. Martin, Auxvasse; W. G. Sims, Mexico; Earl Bell, Benton City; Val Erdel, Rush Hill; Thod Boulware, Molino; Thomas Crawford, Worcester; W. M. Strange, Martinsburg. The directors will elect a manager.

The Bell and Mutual Telephone Company branches at New Franklin have been consolidated by the New Franklin Telephone Company.

MONTANA.

Red River Telephone Co-operative association, from Cut Bank north 25 miles. Capital $5,000. Incorporators, John B. Vallentyne, Warren L. Denny and T. Bruse Bomboy.

Work on a central exchange office in Roundup will begin as soon as material can be assembled for its equipment, according to officials of the Mountain States Telephone Company who visited Roundup recently.

Sioux Pass Farmers' Exchange Company has been organized for the purpose of building a telephone line between Sioux Pass and Fairview. Work will be started at once and rushed to completion.

Supervisor J. B. Seely of the Helena national forest has left for Townsend, where he will put a crew of men to work building a telephone line through the government forest from Townsend to connect with the government line in the Smith river valley. The line will be 16 miles in length.

Farmers' Mutual Telephone Company of Big Sandy, capital $30,000. Directors, John H. Miller, Oscar Marty, H. K. McNabb, Ernest Lundeen and Isaac Lockhart.

The Mountain States Telephone & Telegraph Company has purchased the holdings of the Northern Montana Telephone Company. In the negotiations for the sale the local company was represented by A. F. Lamey of Havre, and the purchasing company by C. C. Cotton of Helena.

NEBRASKA.

New cross arms are being put on the telephone poles between Sumner and Eddyville.

Hastings outranks all other exchanges of the Lincoln Telephone and Telegraph Company in the number of new telephones installed during the first six months of the year, the gain for this city being 223. This made a total of 2,910 telephones in service here on June 30. Beatrice had 2,450 and Nebraska City 1,433.

NEW MEXICO.

It is rumored a telephone line will be installed between Clovis and the northern part of the county. The Clovis Chamber of Commerce is backing the proposition. The plan is to incorporate for $10,000 and sell 400 shares of stock at $25 a share. It is proposed to sell the stock to farmers living along the route the line will follow. Some of the stock also will be held in Clovis. The central exchange will very likely be located at Claud, thirteen miles north of Clovis, and from that point connections will be made with Grady, Hollene, Bellview and Clovis.

NEW YORK.

The annual meeting of the stockholders of the Truxton & Cheningo Telephone Company was held in the office of Frank L. Hilton, September 16. Officers for the ensuing year were chosen as follows: President, Albert Curtis; vice-president, Frank L. Hilton; secretary and manager, Charles W. Beattie; treasurer, Alva R. Muller; directors for three years, C. H. Webster, William Beel and Albert Curtis.

NORTH CAROLINA.

The Southern Bell Telephone Company plans improvements to its exchange in Winston. An addition of 40x60 feet for garage, storeroom, warehouse and supply room will be made.

NORTH DAKOTA.

The telephone exchange at Mandan is being improved.

Grenora is to have a telephone exchange. C. E. Cue has made arrangements for the installation of a board and the construction on lines in the new town.

Work is going forward on the construction of the telephone line from Leith to Valley View. The construction crew was forced to cease work for a time owing to the inability to get poles.

OHIO.

The Automatic Electric Telephone Company of Chicago are installing an individual telephone system in the plant of the Selby Shoe Company in Portsmouth. When assembled it will have 85 telephones and each department in the firm's big plant will be accessible by telephone through its own system.

Independent telephone companies of Ohio plan to hold a big meeting in Columbus during the latter part of November, which will be attended by chief operators, supervisors, toll operators and other employes. Decision to hold such a meeting came after the successful gathering at Indianapolis a short time ago.

OKLAHOMA.

The Pioneer Telephone Company is wrecking its Cleora and Bernice exchanges, the work being now done through the Afton exchange.

H. J. Pettengill, president of the Southwestern Bell Telephone Company, St. Louis, met with John M. Noble, general manager, E. E. Westervelt, secretary and treasurer, and David McKinstry of the Pioneer Telephone & Telegraph Company on official business at their offices in Guthrie.

OREGON.

The Yaquina Bay Telephone Company, of Toledo, has sold its plants at Newport and Toledo to the Pacific Telephone Company. The toll line between these points and valley points is being rebuilt and within sixty days an improved toll service with this section of the coast country will be in operation.

Articles of incorporation of the Alvadore Co-operative elephone Company have been filed with the county clerk by J. B. Sherman, A. Ward, A. J. Brickley, L. A. Holcomb and E. L. Klemer. The capital stock of the company is $1,000, with shares of $20 par value. The principal place of business is Alvadore.

Peoples' Co-operative Telephone Company, Lyons, $600, W. R. Surrey, H. F. Bodeker, Arthur Vaughn, G. F. Johnson and E. A. Taylor.

PENNSYLVANIA.

In some unaccountable manner the cable of the Bell telephone fell down on a heavily charged electric wire, crippling the service in Exeterborough. A gang of men were at once set to work to repair the damages.

Exchange building, Crafton, Allegheny county, Pa. For Bell Telephone Company. Three stories, brick. J. T. Windrim, architect.

The new exchange of the Bell Telephone Company on Wyoming avenue, Kingston, has been started.

An appropriation of $16,450 has been undertaken by the Central District Telephone Company for the construction of a trunk cable between Monessen and Donora, according to information given out by local manager F. B. Burwell.

An expenditure of $15,700 for an additional outside plant for Elizabeth is announced by local manager, J. S. Finley of the Central District Telephone Company. The work will be begun in the near future and calls for the construction of 4 miles of aerial cable varying from 50 to 100 pairs of wires.

SOUTH CAROLINA.

The Chester Telephone Company will enlarge its exchange.

SOUTH DAKOTA.

A deal was recently made whereby the Dakota Central Telephone Company came into possession of the property of the Arlington-Hetland Telephone Company, September 1.

TEXAS.

Mount Calm Telephone Company of Mount Calm, Hill county; capital stock $15,000. Incorporators: J. F. Dixon, W. J. Shilling and B. Hillyer.

C. O. BAKER, Pres. C. W. BAKER, Vice-Pres.

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